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the glass industry

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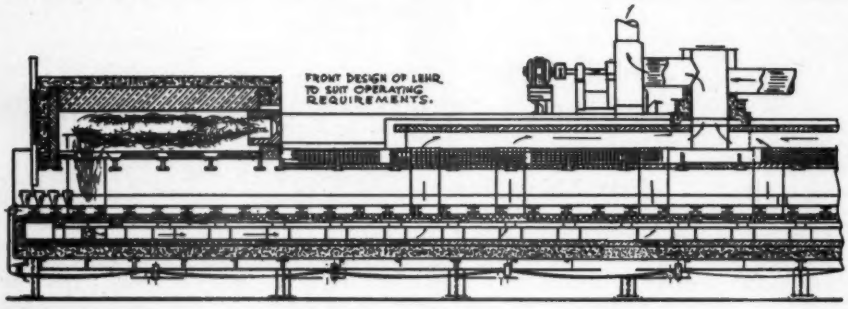

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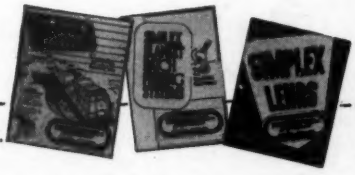

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THE GLASS INDUSTRY

VOLUME 35, NUMBER 4, APRIL, 1954

SOME USES OF RADIOACTIVE TRACERS IN GLASS TECHNOLOGY

By S. F. COX and K. M. LAING

Glass Division Research Laboratory, Pittsburgh Plate Glass Company, Creighton, Pennsylvania

The discovery and use by physical scientists of radiation from the atomic nucleus has given a new and powerful tool to the ceramic scientist. Instruments for detecting this atomic radiation can be very sensitive and accurate. We can thereby locate, identify and measure very small amounts of radiating matter. In tracer technology, such small detectable bits are used as tags or labels by being spread throughout the stable, but otherwise indistinguishable, element that we wish to locate in the sample.

In common with many other physical agencies, atomic radiation can cause damage, perhaps resulting in death, to the experimenter. For example, too much heat or electricity or chemical poison can, and has, caused injuries and fatalities. The primary difference between these more familiar agencies and the newer atomic radiation is the absence of human sensory response to the latter. Fortunately, instrument response is possible and is so adequate that in this era of the health physicist, no more than a dozen or so of the many thousands of atomic experimenters or operators has been damaged, and only two or three killed.

In the industrial radioisotopes laboratory, the topic of personnel safety is served by intelligent familiarity with the various radiations by the use of calibrated health survey instruments and by the use of pocket electroscopes. Small insidious doses are recorded and accumulated on film badges. The permissible dose suggested by safety officials is a quite small, 300 milliroentgens per week. This is exceeded by the natural cosmic ray dosage received by people who live at the highest altitude levels, such as Peruvians and Thibetans.

Some of the state health authorities have made or are making laws to enforce good safety practices in work with radioactive isotopes. As a matter of fact, deviations from safe practices are more likely to be found among those who work in the life science field with radium and X-ray tubes.

The earliest work with radiating materials came before the advent of the age of the atom. There is a whole class of materials that is naturally radioactive. The phenomenon was discovered by Bequerel in 1895. Not many years after that, experimenters became interested in the reactions of the new active materials with the glass walls of their laboratory containers. Early studies reported the specific adsorption of radioactive ions on various kinds of glass.

In recent years, work along this line has been done by Willard at the University of Wisconsin and his collaborators, and has been published by them in a series of papers.[1, 2, 3, 4] Of course, their work with the surface chemistry and physics of glass has not been confined to the few naturally radioactive isotopes available. The contemporary experimenter finds about 870 radioactive isotopes. Of these, 435 have half lives of more than three hours. The most rapidly decaying of these must be used the same day they are made. There are five isotopes of shorter half life which grow from the decay of species available, and so are useful in some cases. Of the 440 or so possibilities, 123 are available from the AEC and 18 are naturally radioactive. This information came from manipulating a set of punched cards. These constitute a system of isotope classification originated and published by our laboratory[5].

These active atoms are the tools of this technology. The handles of the tools are radiations emitted from the unstable nuclei of these atoms, and the tongs by which we lay hold of the "hot" handles of the tools are the various radiation-sensitive detectors and instruments.

The work done with naturally occurring material includes that of Aberg[6] with thorium-X, or radium 224. With aid of this isotope, he determined the rate of sin-

Taken from a talk given at the First Symposium on Radioceramics, Rutgers University, New Brunswick, New Jersey.

tering and fusion of powdered glass. Lindroth[7, 8] has used this same material and method to study the crystallographic transformations as glass forming mixtures are heated to fusion.

Determining the diffusion coefficients of various constituent elements in glasses has been difficult by other methods, Johnson, Bristow and Blau[9] have used radioactive isotopes to reveal this coefficient. They melted salts carrying radio-tracers onto the ends of glass rods. After diffusion had occurred at elevated temperatures for definite times, the rods were allowed to photograph themselves on a film in the dark. The blackening of the film, caused by radiation from the tracer as it had spread along the rod, was measured.

Another method is to grind successive layers off the sample and measure the activity of each grinding slurry with a radioassay instrument. Fitzgerald's work in this field involved the generation of the radio-isotope right in a thin layer of the glass sample. Some of the ordinary sodium in the glass was changed to radiosodium, which transmutes itself eventually to magnesium. The sodium was activated by bombarding the sample with a beam of fast deuterons, or ions of heavy hydrogen. These were accelerated in the cyclotron of the University of Pittsburgh. Such a process, called activation analysis, can be used to identify and measure elements present in glass in a very small concentration. Other radioisotopes, coming from Oak Ridge, were used in diffusion coefficient studies. These included potassium 42, silver 110, calcium 45 and copper 64.

Another technique is shown by an experiment with a tank block refractory. A sample of the particular material under investigation was sent to Oak Ridge, where it was put in the pile. Some of the chromium it contained was made radioactive. Upon return, the sample was built into the wall of a small experimental glass melting tank. Radioactivity measurement of the glass emerging was followed to determine the rate of attack on the refractory sample.

More work along refractory material lines was reported by Laing, Jones, Emhiser and Fitzgerald[10, 11]. Using photographic detection of radioactive sodium, we studied the disposition of much larger concentrations of normal sodium in refractory samples. Sometimes the radioactivity was induced by cyclotron bombardment. Other experiments used molten glass, with added radiosodium from Oak Ridge, in which the refractory samples were eroded.

Another study, published by Fitzgerald[12], used radioactive sodium in surface layers of glass samples to study dealkalization. The labelled sodium in the surface layers was measured after it transferred into applied coatings of various oxides at elevated temperatures. To measure the efficiency of the transfer, he counted the activity in the oxide after it had been scraped off the samples.

Some European work has been reported by Peyches[13], Director of Research.* The three examples he gives concern convection currents in glass tanks, investigations of the glass lubricant in hot steel drawing and the polishing process in plate glass manufacture.

In the first experiment, he tells of the addition of sodium 24, melted into a high activity "stock solution" glass, to a small glass melting furnace. He recommends no less than 1 millicurie per ton of furnace capacity, and actually used 3 mc/ton. He radioassayed samples of the draw, as well as specially obtained samples from the surface and from deep in the molten glass. Calculation showed the proportion of stagnant glass and the relative inhomogeneity with time.

The conclusion was made that movements in the glass, revealed by the radiosodium, resulted in inefficiency and poor mixing. The direction of the flame was changed and some iron oxide was added to the melt to make it intercept more of the thermal radiation from the flame and the crown. These measures improved the conditions somewhat, as shown by another test with radiosodium. However, Peyches concludes that further improvement would come by the impact of the newly derived information on the engineering design of a new tank.

The next example is a study of the thickness of the film of glass on a steel rod drawn with hot glass as lubricant. Conventional analysis was confused by contamination of the film by molten salt from the subsequent quenching bath and by the small samples available. Glass lubricant with active strontium 89 substituting for some of the calcium was used. Glass thicknesses of 15 to 20 microns were easily measured.

The third case involved the study of the polishing process. Glass also labelled with strontium 89 was polished with rouge on felt under conditions approximating that of factory production. The activity transferred to the felt and to the rouge slurry was followed. One disintegration per minute as measured on the felt corresponded to 3×10^{-5} gm of glass. In the slurry of glass and rouge, this activity corresponded to 5×10^{-5} gm.

Leaving the artificial radioactive materials for the moment, let me refer to a phenomenon that we observed when doing some work with polonium 210, one of the radium family. This is an emitter of energetic alpha particles, which are helium nuclei. We found that a thin film of polonium placed next to a glass surface left an active residue on the glass after the film was removed. This was not ordinary surface contamination for we found that even after a thin layer of glass had been removed, alpha activity was still apparent. We conjecture that the nuclear reactions and adsorptions in the polonium imparted sufficient energy to yet inactive atoms to remove them from their places in the layer of polonium and to impel them into the glass. They have enough velocity to bury themselves comparatively deep in the glass where they await their inevitable disintegration and detection. This phenomenon was used in a study of glass removal during polishing.

Slightly removed from a strict interpretation of the title is the field of thickness gauging. Since matter intervening between source and detector absorbs some of the radiation, much valuable use has been made of radioactive isotope thickness gauges. Limitations of range and accuracy have prevented widespread application to the glass industry, but the advance in development of such devices may bring them into useful employment among us. A thickness gauge which depends on the scattering of beta particles through a large angle back into a detector may be the first we employ to continuously find, without material contact, the thickness of films of various sorts on glass, including paint films on mirrors.

(*Continued on page* 222)

* Le Centre de Recherches des Glaceries de Saint-Gobain.

GLASS SESSIONS TO EMPHASIZE DISCUSSION AT A.C.S. ANNUAL MEETING

The Palmer House in Chicago will be headquarters for the 56th Annual Meeting of the American Ceramic Society, April 19 through 23.

While more than 160 technical papers have been scheduled for presentation, this is considerably less than the number given at the New York meeting last year. One reason for the reduction in the total number of papers may be seen in the fact that Glass Division Chairman Norbert J. Kreidl and Tyler G. Pett, Program Chairman, have insisted on keeping the number of glass papers small enough to permit adequate discussion on each paper.

The Glass Division's meeting will be held in the Palmer House, as well as those of all other divisions of the Society. Following is the list of 17 Glass Division papers to be presented:

"Internal Friction at Low Temperatures and High Frequencies in Fused Quartz," O. L. Anderson, H. J. McSkimin, M. E. Fine and H. E. Bommel, Bell Telephone Laboratories; "Foreign Fourcault Practice," T. G. White, Pittsburgh, Pa. (to be read by F. V. Tooley, University of Illinois); "The Strength Versus Diameter of Glass Fibers," W. H. Otto, Owens-Corning Fiberglas Corporation; "Further Use of Selected Area Electron Diffraction for Studying Glass Structure," J. W. Michener and J. G. Sayre, Owens-Corning Fiberglas Corp.; "Fine Annealing of Optical Glass," H. R. Lillie and H. N. Ritland, Corning Glass Works; "The Constitution of Soluble Phosphate Glasses," A. E. R. Westman and Joan Crowther, Ontario Research Foundation; "Expansion of Vitreous Silica," Harold T. Smyth, Rutgers University; "Physical Chemistry of Finely Subdivided Matter," W. Weyl, Pennsylvania State University; "Determination of the Resistivity of Lossy Materials from Dielectric Measurements, Making Use of Interfacial Tension," R. T. Lewis, N. Y. State College of Ceramics, and L. R. Bickford, Jr., International Business Machines Corporation; "High Pressure Minerals," Loring Coes, Jr., Norton Company; "Effects of Nuclear Reactor Exposure on some of the Properties of Vitreous Silica and Quartz," W. Primak, L. Fuchs and P. Day, Argonne National Laboratory; "Wettability on Certain Metals by Potassium Silicate and Sodium Borate Glasses," J. A. Pask, Alex Kaminski and D. W. Mitchell, University of California; "Recent Applications for Conductive Glass in the Lighting Field," R. M. Rulon, Sylvania Electric Products, Inc.; "A Flow Type Viscometer for Measuring Glass Viscosity," R. L. Tiede, Owens-Corning Fiberglas Corporation; "Adaptation of Replica Technique to the Measurement of Surface Durability of Glass," H. E. Simpson, N. Y. State College of Ceramics; "Surface Tension, Density, Viscosity and Electrical Resistivity of Molten Binary Alkaline-Earth Borates," Leo Shartsis and H. F. Shermer, National Bureau of Standards; "Thermal Conductivity of Glasses," Edwin Ruh, Harbison-Walker Refractories Co.

The Basic Science Division heads all other divisions as to number of papers, with 31 highly technical presentations scheduled for delivery at its five sessions. The Refractories Division program, often containing papers of direct interest to glassmen, is composed of 20 papers. The complete list of titles follows:

"Dense Silicon Carbide and Metal Bonded Silicon Carbide," R. A. Alliegro, L. B. Coffin and J. R. Tinklepaugh, N. Y. State College of Ceramics; "The Structure and Orientation of Hot Pressed Silicon Carbide," L. B. Bassett and A. D. Joseph, N. Y. State College of Ceramics; "Heat Treatment Studies of Cobalt & Nickel Bonded Titanium Carbide," C. K. Russell and A. W. Allen, University of Illinois; "Application of Photoelasticity to the Design of Tensile Specimens for Ceramic Metal Materials," M. B. Stiefel, National Bureau of Standards; "Alkali Attack on Carbon Brick," R. T. Nelson, U. S. Steel Corp.; "The Effect of Impurities in Carbon Monoxide and in Iron Oxide on the Deposition of Carbon and the Formation of Hagg Chloride," T. F. Berry, R. N. Ames and R. B. Snow, U. S. Steel Corp.; "Basic Regenerator Refractories in a Borosilicate Glass Wood Furnace," R. J. McEvoy and A. C. Siefert, Owens-Corning Fiberglas Corp.; "Future Developments in the Refractory Field," E. B. Snyder, Wheeling Steel Corp.; "Symposium: Where Do We Stand," E. F. Osborn, Pennsylvania State University, R. E. Birch, Harbison-Walker Refractories Co., and H. M. Kraner, Bethlehem Steel Co.; "A Study of the Secondary Expansion of a Flint Fireclay," R. R. West, New York State College of Ceramics; "The Effect of Firing Temperature on the Properties of Fireclay Brick," G. R. Eusner and W. S. Demenham, U. S. Steel Corp.; "The Use of Pyrophyllite in Castable Refractories," I. W. Gower and W. C. Bell, North Carolina State College; "Factors Influencing the Physical Properties of Refractory Concrete," W. C. Hausen, Universal Atlas Cement Co.; "Temperature Dependence of Thermal Con-

(*Continued on page* 214)

SAFE LOAD IMPACTS

By HENRY E. WALKER, Asst. Superintendent
Harding Glass Company, Fort Smith, Arkansas

How much impact will your load stand and still give you a satisfied customer at destination? Perhaps all impacts that occur are safe ones when the load arrives safely.

How about the load that your loading foreman, checker and blocker will bet you money on safe arrival? You invite the R. R. people to inspect the load and they kid you about your heavy blocking and scoff at the idea that anything could possibly disturb the load? And you get a wire from the customer upon arrival telling you that your blocking and bracing has failed and the load is badly damaged?

Or the item that you have regularly shipped a thousand miles by rail safely, have the bottoms broken out when you haul 200 or 400 miles by truck—probably emphasizing some of the points made by R. F. Bisbee in his paper, "Pretesting Packaged Products for Safe Transit", and particularly in the article, "Reducing Damage in Transit", by E. R. Dytko and R. W. Luce, Jr., in *Modern Material Handling*, October, 1953.

In Mr. Dytko and Mr. Luce's article they pictured a truck crossing a R. R. track and posed the question, "Would you prefer to see him hit them at 11 mph. or 20 mph.?" "The lower speed, of course." Then came the punch line, "Brother in this particular case you couldn't be more wrong! The 11 mph. speed caused a shock more than 200% greater than the 20 mph. speed. And herein lies the secret of many a damaged shipment."

Mr. Bisbee captured my attention in the opening statement of his address to the General Session of the American Ceramic Society meeting in New York this year when he said in part, "All manufacturing, engineering and quality efforts are in vain if the product reaches its destination in a damaged condition." I was reminded that we had just concluded an experiment that we called an "Impact Test" involving quite a program of bumping and handling of standard loaded cars of window glass, or pretesting cars loaded with window glass, if you please!

During the past years we loaded, blocked and braced, rail shipments in particular, to the best of our know-how and ability and received the blessing of the carrier on practically every load inspected by them prior to shipment. The carrier was more critical of over-blocking than lack of it. Nevertheless, we would receive notice of damage to some of these shipments upon arrival.

On many shipments we requested the carrier to install impact recorders and for some unknown reason the majority of these would go through unharmed. Our ability to secure tapes from these recorders for inspection and study was limited. In many cases something happened to the recorder—the clock stopped, it broke or something else happened.

Because of our desire to learn something about what happened to the load in transit so that we might determine standards of our own for or against which we should fortify our loads, we purchased an impact recorder with a 16-day clock, realizing in the beginning

Presented before the Fourteenth Conference on Glass Problems, University of Illinois, Urbana, Illinois.

Fig. 1. A long stretch of straight track in the railroad yards was designated as the test track and ten loaded coal gondolas were close-coupled and brakes set at one end of the track to form a dead man or bumper to shove the loaded cars against. This is shown just after the first impact and inspection.

IMPACT TESTS

April 21, 1953

2:00 PM — COUPLINGS
Car #1- 2MPH Car #2-4MPH Car #3-5MPH

2:15 PM — CARS KICKED
Car #3- 7MPH Car #2-6MPH Car #1-3MPH

2:30 PM — CARS KICKED
Car #3- 7MPH Car #2-6MPH Car #1-4MPH

2:45 PM — CARS KICKED
Car #3- 9MPH Car #2-8MPH Car #1-5MPH

3:00 PM — CARS KICKED
Car #3- 9MPH Car #2-8MPH Car #1-6MPH

3:15 PM — CARS KICKED
Car #3-11MPH Car #2-9MPH Car #1-7MPH

3:30 PM — CARS KICKED
Car #2-10MPH Car #1-8MPH Car #3-STOPPED

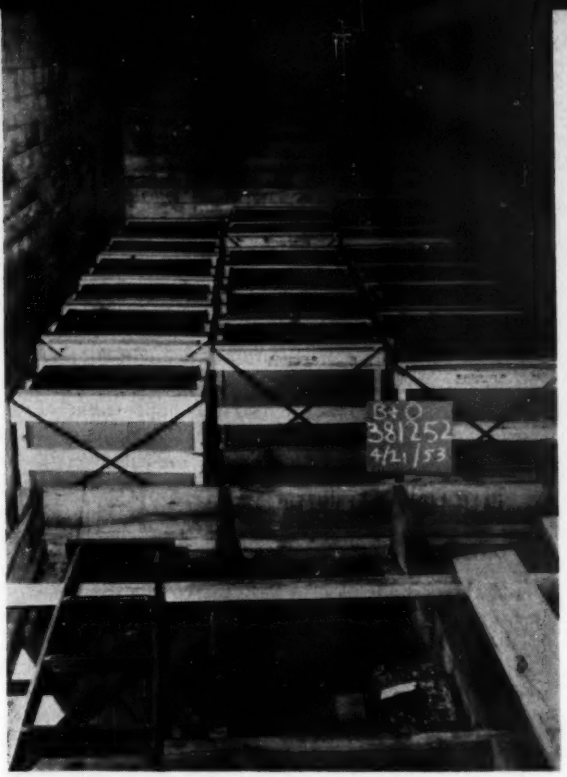
3:45 PM — CARS KICKED
Car #2-11MPH Car #1-9MPH Car #3-STOPPED
(double coupling)

4:00 PM — CARS KICKED
Car #1-10MPH Cars #2 and #3 STOPPED
(double coupling)

4:15 PM
Car #1-11MPH Cars #2 and #3 STOPPED
(double coupling)

Number One (#1) Car will be the South Car: Number Three (#3) the North.

Fig. 2. Three cars of window glass that had been loaded, blocked and braced ready for shipment to the customer, by employees who did not know that these cars would be selected for testing, were lined up about a car length apart on the upper end of the track. The engine then coupled the cars, hitting car No. 1 at 2 mph., Car No. 2 at 4 mph; and Car No. 3 at 5 mph.



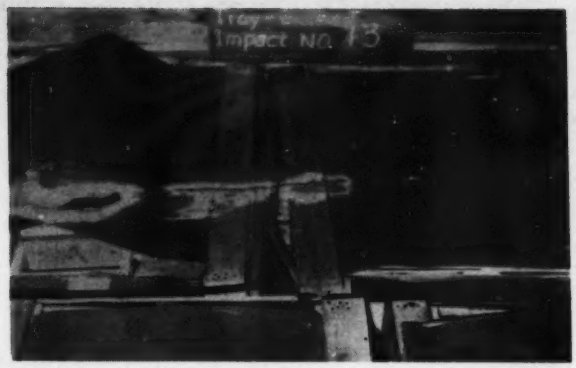


Fig. 3 (left). Car No. 1 was loaded with 26 pallets ranging from 1500# to 2000# and 35 standard 50′ boxes window glass. The load was divided, leaving about 8 or 10′ open floor space in the doorway. The load was blocked with 2 x 8 rough oak on edge.

Fig. 4 (below). This car was subjected to ten impacts ranging from 5 mph. to 10 mph. as shown on the graph chart. The blocking and bracing was not damaged.

Fig. 5 (above). Some repairs were made to pallets because of damage such as shown above, but none on 50′ boxes. Three were 7 lites of 12 x 44 S.S. glass broken in this car, for most part just a corner off. There was no other damage to glass noted. The load developed no slack under 6 mph. impact. The crate damage did not become evident up to 7 mph. impact.

IMPACT TESTS

TEST CAR NO. 1 **CAR NO. BO-381252**

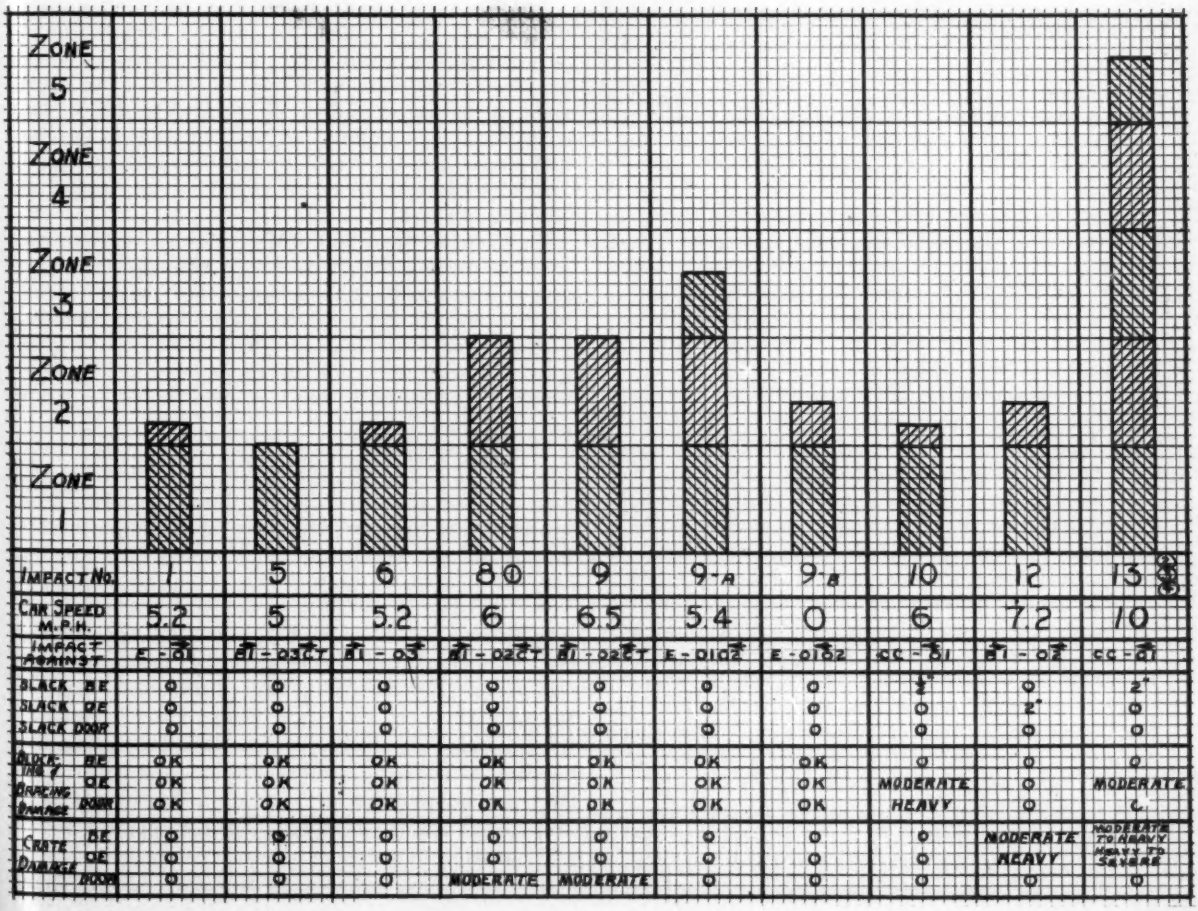


Fig. 6. Car No. 2 was loaded with 670 standard 50′ boxes "B" S.S. window glass. The load was divided, leaving about 15′ of open doorway. This was blocked by using 2 x 4 rough pine spiked to floor across front of boxes and 2 x 4 rough pine stringers or stiff legs spiked to the floor between them.

that we could secure only a part of the story with one recorder. We decided to check for impact on a horizontal plane and in a line parallel to the line of travel.

I would like to say here that during all of our research and investigation, a good working relationship has been maintained with the carriers with all data available to them at all times.

At the beginning, the impact recorder was installed in cars traveling only a short distance so that we could gain some quick experience with it. The haul distances were gradually increased to the maximum. We learned that when damage occurred to the load, the recorder usually indicated heavy impacts. We saw very few of the damaged loads at their destination. Therefore, we were unable to determine some facts that were needed.

What is rough handling or a heavy impact? The carriers told us that anything over 4 mph. was rough handling and also that anything in the third zone of the recorder-chart was a heavy impact.

Our question was—what would 4 mph. impacts do to our blocking and bracing? Which would do the most harm, several at 3 or 4 mph. or one at a higher rate of impact? Why were we having damage from block and bracing failure when both the carrier and ourselves felt sure that it was adequate?

Early in January 1953, we conceived the idea that we should conduct some controlled tests using actual loads ready for shipment to the customer. Whereupon we formulated a plan to conduct impact tests provided we could secure the cooperation of our servicing railroad. The "Frisco" railroad officials expressed their interest and pledged their cooperation in conducting such tests.

In a meeting with our Shipping Department and Engineers, we outlined a plan for conducting impact tests that would come close to duplicating actual train impacts, employing three cars of window glass loaded, blocked and braced ready for shipment to customers. The general plan was to roll the cars of glass against a fixed object at varying car speeds, beginning at 2 mph. and running up to 11 mph., which is the upper limit of our impact recorder chart, and after each impact to check for damage and record the impact indicated on the recorder, along with other available data. We could thus relate the Impact Recorder readings to service impacts and be enabled to set our loading standards to meet the service requirements.

We outlined our plan to local Frisco officials and, after incorporating their constructive ideas into the plan, set April 21, 1953 as the date to conduct the tests. April, being designated "Perfect Shipping Month", coincided with our objective.

A long stretch of straight track in the R. R. yards was designated as the test track and ten loaded coal gondolas were close-coupled and brakes set at one end of the track to form a dead man or bumper to shove the loaded cars against, which is shown in Fig. 1 just after the first impact and inspection.

Three cars of window glass that had been loaded, blocked and braced ready for shipment to the customer by employees who did not know that these cars would be selected for testing were lined up about a car length apart on the upper end of the track. The engine then coupled the cars, hitting Car No. 1 at 2 mph., Car No. 2 at 4 mph. and Car No. 3 at 5 mph. engine travel speed. Following this the series of impacts were executed as outlined in Fig. 2.

To determine the speed of the cars before impact, two white marks were set on the rails a given distance apart and two men with stopwatches clocked the car across these marks (having prepared a time-distance chart beforehand for convenience). The engineer judged his speed by trial runs and his engine speedometer, and turned the car loose before it entered the speed timing zone each time.

The car doors were fastened in "open" position and after the coupling operation each car was inspected and data recorded, pictures taken, etc. (each car having been inspected and photographed prior to the first impact). After Car No. 1 bumped the coal cars, it was inspected and left coupled to the coal cars, as shown in Fig. 2, with the ladder in the door of the car; Car No. 2 was bumped into Car No. 1 at 4 mph. and left coupled and both Cars No. 1 and 2 were inspected; then Car No. 3 was bumped into Car No. 2 and all three cars were inspected. The cars that were being bumped were inspected each time, along with those bumping because the direction of impact was reversed to the first impact and the type damage different. The cars being bumped were subjected to a humping action or what appeared to be the floor rising in the center of the car.

Car No. 1 was loaded with 26 pallets ranging from

1500# to 2000# and 35 standard 50′ boxes window glass. The load was divided, leaving about 8 or 10′ open floor space in the doorway. The load was blocked with 2 x 8 rough oak on edge as shown in Fig. 3. This car was subjected to ten impacts ranging from 5 mph. to 10 mph. as shown on the graph chart in Fig. 4 and the blocking and bracing was not damaged. Some repairs were made to pallets because of damage such as that shown in Figs. 5 and 6, but none on 50′ boxes. There were 7 lites of 12 x 44 S. S. glass broken in this car; for most part, just a corner off. There was no other damage to glass noted. The load developed no slack under 6 mph. impact. The crate damage did not become evident up to 7 mph. impact.

Car No. 2 was loaded with 670 standard 50′ boxes "B" S. S. window glass. The load was divided, leaving about 15′ of open doorway. This was blocked, Fig. 8, by using 2 x 4 rough pine spiked to the floor across front of boxes and 2 x 4 rough pine stringers or stiff legs spiked to the floor between them. This car had eight impacts ranging from 5.2 to 7.9 mph. and the recorder registered 4 impacts in the third zone and one in the fourth, as shown on the chart in Fig. 10.

On the first impact, a 5.2 mph. engine speed, the recorder registered in the fourth quarter of the fourth zone. This impact broke the floor block across the front of the boxes in the brake-end between every stringer. The broken blocking was replaced. Slack such as that shown in Figs. 9 and 11 developed as the bracing broke.

Fig. 7. On the first impact, a 5.2 mph. engine speed, the recorder registered in the fourth quarter of the fourth zone. This impact broke the floor block across the front of the boxes in the brake and between every stringer.

Fig. 6a (below). This car had eight impacts ranging from 5.2 to 7.9 mph. and the recorder registered 4 impacts in the third zone and one in the fourth.

IMPACT TESTS

TEST CAR NO. 2 **CAR NO. N.P. 31362**

ZONE 5 / ZONE 4 / ZONE 3 / ZONE 2 / ZONE 1									
IMPACT No.	2 (5)	7 (3)(2)	8	9	9-A	9-B	11 (3)(2)	12
CAR SPEED M.P.H.	5.2	7.9	6	6.5	5.4	0	6.6	7.2
IMPACT AGAINST	← B1 - 02 →	← B2 - CT →	← B1 - 02 CT →	← B1 - 02 CT →	← E - 0102 →	← E - 0102 →	← B2 - CT →	← B1 - 02 →
SLACK B.E.	0	1"	½"	1½"	0	0	2"	2"
SLACK O.E.	0	1" TO 5"	0	0	0	0	10½" TO 0"	
SLACK DOOR	0	0	0	0	0	0	0	
BLOCKING & BRACING DAMAGE — B.E.	SEVERE	0	0	SEVERE	0	0	0	0
BLOCKING & BRACING DAMAGE — O.E.	0	SEVERE	0	0	0	0	SEVERE	0
BLOCKING & BRACING DAMAGE — DOOR	0	0	0	0	0	0	0	0
BOX DAMAGE — B.E.	MODERATE	0	0	0	0	0	MODERATE TO HEAVY	0
BOX DAMAGE — O.E.	0	0	0	0	0	0	MODERATE	0
BOX DAMAGE — DOOR	0	0	0	0	0	0	0	0

Fig. 8. On the next impact, a 7.9 mph., the recorder registered in the third quarter of Zone 3 and the blocking in front of the boxes was broken between every stringer in the other end. The broken blocking was replaced.

On the next impact, a 7.9 mph., the recorder registered in the third quarter of Zone 3 and the blocking in front of the boxes was broken between every stringer. The broken blocking was replaced. Finally, on the 7th impact, at 6.6 mph. and the recorder reading in the fourth quarter, the stringers and cross members in the brake-end turned loose and some of them hit the roof of the car leaving it as it appears in Fig. 12. This blocking was replaced. There was no damage to boxes or glass. Fatigue of earlier impacts probably took its toll in making the stringers come loose. The final impact was at 7.2 mph. with no damage. However, the recorder only broke the first quarter of Zone 2. A design change was indicated on the blocking.

Fig. 9. Slack developed as the bracing broke.

Fig. 10. Finally, on the next to last impact, at 6.6 mph. and the recorder reading in the fourth quarter of Zone 3, the stringers and cross members in the brake end turned loose and some of them hit the roof of the car leaving it as it appears above. This blocking was replaced. There was no damage to boxes or glass. Fatigue of earlier impacts probably took its toll in making the stringers come loose. The final impact was at 7.2 mph. with no damage. However, the recorder only broke the first quarter of Zone 2. A design change was indicated on the blocking.

Car No. 3 contained 1181 standard 50′ boxes of window glass. The load was solid from end to end, all the floor being covered with boxes of glass, as shown in Fig. 13. Several boxes of glass were taken out in the doorway to make room on the floor for the impact recorder. This was done at the last minute and the opening was not properly blocked. This weakness allowed some movement in a portion of the load that should not have occurred.

This car had four impacts, as shown on the chart in Fig. 14. The first one at 5.2 mph. registered in the third quarter of Zone 3 and developed about 3½″ to O″ slack in other end of car. There was some damage to boxes, loose lids and a few sheared lids as shown in Fig. 15, the heaviest damage being in the doorway surrounding the void made for the recorder. The second impact at 9.4 mph. registered in the fourth quarter of Zone 4 caused considerable damage to boxes and developed 3 to 5″ slack in the other end of the car. Before shipping the car to the customer, 30 boxes were repaired and 16 were replaced. One lite of glass was broken; it had a small corner off.

Following the impact tests, the three cars were re-

turned to the Harding plant for final inspection, repairs, reloading, bracing and blocking. The impact recorders were moved from the floor to the sidewalls of the cars and each car was released to the railroads as originally planned. The three customers, one in Troy, Alabama, one in Waco, Texas and the other in Meridian, Mississippi, were contacted regarding the shipments and they reported, along with the carriers, that all cars were received in good shape with no exceptions.

It was noted that mph. and impact registered on the recorder did not follow a set pattern. This was perhaps due to the varying slack or softness of the couplings. This was checked by coupling into loosely coupled cars and into a heavy load of chat, and then running the load

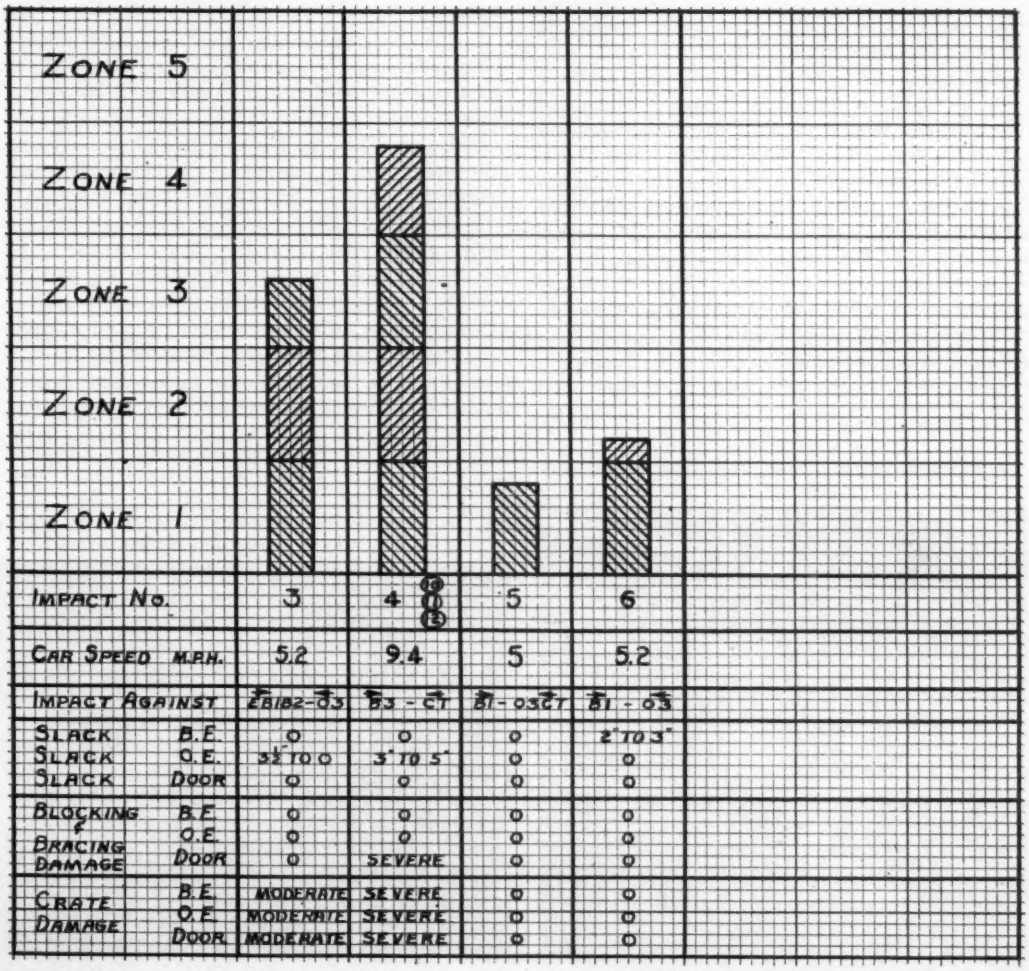
(*Continued on page* 216)

Fig. 11 (below). Car No. 3 contained 1181 standard 50′ boxes of window glass. The load was solid from end to end, all the floor being covered with boxes of glass. Several boxes of glass were taken out in the doorway to make room on the floor for the impact recorder. This was done at the last minute and the opening was not properly blocked. This weakness allowed some movement in a portion of the load that should not have occurred. This car had four impacts. The first one at 5.2 mph. registered in the third quarter of Zone 3 and developed some slack on other end of car.

Fig. 12 (right). There was some damage to boxes, loose lids and a few sheared lids. The heaviest damage was in the doorway surrounding the void made for the recorder.

IMPACT TESTS

TEST CAR NO. 3 **CAR NO. NP-17020**



IMPACT NO.		3	4	5	6
CAR SPEED M.P.H.		5.2	9.4	5	5.2
IMPACT AGAINST		E81B2-B3	B3 - C1	B1 - B3C1	B1 - B3
SLACK	B.E.	0	0	0	2" TO 3"
SLACK	O.E.	3½" TO 0	3" TO 5"	0	0
SLACK	DOOR	0	0	0	0
BLOCKING & BRACING DAMAGE	B.E.	0	0	0	0
	O.E.	0	0	0	0
	DOOR	0	SEVERE	0	0
CRATE DAMAGE	B.E.	MODERATE	SEVERE	0	0
	O.E.	MODERATE	SEVERE	0	0
	DOOR	MODERATE	SEVERE	0	0

STEMS WITHOUT STRAINS

By CLAYTON R. COWLEY, Glass Engineer
Production Engineering Department, Sylvania Electric Products, Inc., Emporium, Pa.

Whether our preference is for hot music or cold facts, we all expect our radios to bring in all types of programs year after year without failure. Yet the effects of hot and cold temperatures inside the set are seldom considered. Dependability is taken for granted, even though the tubes and other parts are baked and cooled every time the receiver is turned on and off.

Radio tubes derive a good part of their dependability and long life from annealing operations which relieve strains and stresses in the glass bulbs and stems. Without annealing, the alternate heating and chilling might cause early tube breakdown.

For annealing glass stems, the Sylvania Electric Products, Inc. plant at Emporium, Pa. utilizes electric annealers made by Forter-Teichmann Company. In a radio tube, the glass stem is the important inner structure. It holds the stiff wires which support the tube elements and connect them to the base prongs. The glass stem also includes the evacuating tube which seals the vacuum.

Radio tubes are generally considered to be the heart of electronic equipment, and glass stems might be thought of as the "heart of the heart". Production quality of the glass stems is a vital factor in the value of the final product because the stem is the first piece made, the part to which all other parts are added.

Glass tubing and wires are the raw materials for tube stems. Sylvania cuts the prescribed diameter tubing and wires to length and then feeds them to the stem-making machine. Here, fine jets of flame soften parts of the glass, and the evacuating tube and wires are imbedded. Following placement of these parts, the stem assemblies move directly into the annealing chamber. An electric annealer is located at the end of each stem-making machine.

Because the flames soften some parts of the glass more than others, many strains are set up as the glass starts to cool, and stress relief becomes a necessity. In annealing, temperature control is the all-important factor. Too much heat causes the glass to sag. Too little heat is ineffective. In addition, it is imperative that the first zone of the annealer be the same temperature as the warm glass, otherwise thermal shock will damage many of the stems.

* Trademark, Hoskins Corp.

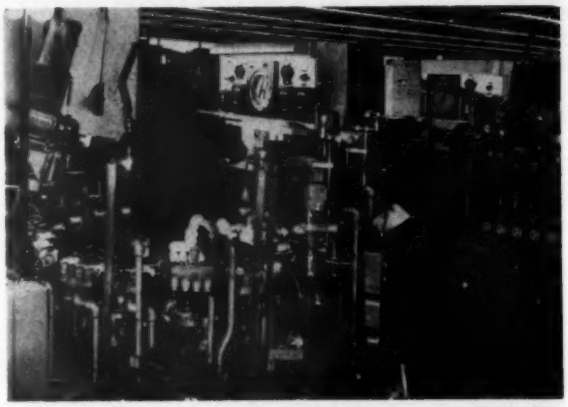


Fig. 2. Stem-making machine feeds hot stems directly to annealer.

In the electrically heated annealer, the temperature of the middle zone is controlled by an electronic circular chart controller designed by Minneapolis-Honeywell Regulator Company. Since the annealer has a known temperature gradient, the temperatures of the end zones are also established by the setting of the middle zone. The pyrometer controller has 24-second pen speed, 0-1600 F scale, a 24-hour chart and a SPST 30 ampere mercury switch control unit. Type K (Chromel-Alumel*) thermocouples are used. Auxiliary switches sound alarms if the annealing temperature deviates from the set point.

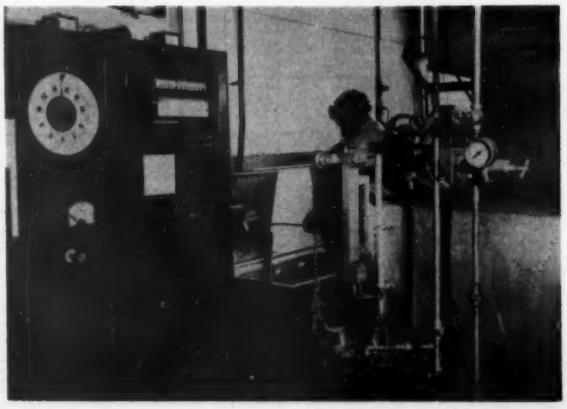
This installation at Emporium is typical of the use of annealing equipment in several other of the firm's plants. Already 49 of this type of annealer have been put in service by many of the leading radio tube makers.

Associated with maintenance of the stem-making and

(*Continued on page* 214)

Fig. 1. Processed stems pour from annealer into inspection bin.

Fig. 3. Honeywell's electronic circular scale instrument controls heat of tool hardening furnace.



SUMMARIES OF GLASS CONFERENCE PAPERS

Glass Tank Insulation, By Harold W. Baque
Dolomite for the Glass Industry, By Louis G. Love
Control of Batch and Glass Composition, By J. P. Poole
Evaluation of Carloading Methods . . . By John G. Turk
Special Refractories for Superstructure and Feeder Parts, By R. W. Knauft

Glass Tank Insulation

By Harold W. Baque
Corhart Refractories Company, Louisville, Ky.

The insulation of glass melting tanks in all their parts seems to be attracting a growing interest among operators. The reason seems to be that refractory manufacturers have improved their products over the years to a point where today this is possible.

Insulation is being successfully applied today to practically every part of furnaces in high-capacity operation. One man may have his furnace crown insulated, another the regenerator, and another the furnace basin. There is no reason, it would seem, why this could not all be done on any one furnace. Glass furnaces, however, are expensive play-things and those whose money is involved are inclined to be a bit conservative, naturally.

Briefly, the several parts of a furnace and the steps that have been taken to insulate them are as follows:

Crowns. There are many Hartford unit melters in use. While a small furnace, it is operated at temperatures and pulls comparable to larger regenerative units. These furnaces have silica insulating brick over the crown brick and a plastic high-duty insulating material over that and this construction stands up successfully in use. Some larger furnaces have insulated crowns and high furnace pressures, and high gas velocities might make this unwise. However, in the majority of furnaces, such construction seems entirely possible if certain precautions are taken: (1) do not insulate an old furnace cap that has dust on it and in the joints, (2) it is wise to heat the furnace up with the crown uninsulated, inspect for open joints and seal well with silica cement before applying the insulation, (3) sealing is probably desirable with crown insulation to keep furnace vapors from being forced into brick where they condense.

Breastwalls. Breastwalls are and have been insulated for many years. The practice should be more general as available refractories stand up well with insulation behind them.

Port-necks. Insulation of this area not only reduces thermal losses, but makes maintenance and changing of burners a more comfortable job and decreases the glassy build-up in the ports by keeping the temperature high enough to prevent condensation of vapors. This glassy build-up can cause stones and cords in colored glasses and side machine ream in flat glass.

Regenerators. This area has for some time been generally insulated. Sealing by metal casing methods may lower air infiltration.

Melter Sidewalls. Insulation of this area is a highly controversial subject, but today's super refractories make it possible. It is debatable in the case of flint glass furnaces as little reduction in fuel has been noticed. In the case of colored glass, the great problem is to maintain glass temperatures below the surface high enough to speed the solution of stones and batch material. Sidewall insulation accomplishes this. The practice has been to leave an area at the metal line and six to eight inches below free, and cool as usual. The remainder of the area is insulated.

Melter Bottoms. Pavements of fusion cast blocks over clay bottoms have been tried over the past several years. Such pavements, properly installed, stand up amazingly well and by maintaining practically the same thickness throughout a campaign, provide real fuel saving over that period when clay bottoms normally become thin and had to be preserved with air or water. Several old thin bottoms have been cleaned off, leveled up, and paved with three or four inches of fusion cast material and the furnaces restarted without other repair to finish out the sidewall life. On new construction, the most common practice has been to lay four inches over eight inches of flux clay. This construction works into present structures without any changes in iron work or decrease in furnace depths. The pavings must be laid in a bed of resistant mortar since the secret of a successful pavement probably lies in holding the glass to its top surface and not allowing any to get beneath it.

Other Areas. Refining ends or noses are often insulated, but it seems doubtful that this is even desirable under present-day furnace loads. So-called refining ends have become really cooling ends. As such, sidewalls should act as a cooling medium. Nose crowns are frequently insulated to minimize condensation. This is not an uncommon practice today. The elimination of silica drip and wash in this location is more important probably than such heat radiation as an uninsulated crown could give.

Dolomite for the Glass Industry

By Louis G. Love
National Lime and Stone Company, Findlay, Ohio

The word dolomite has become loosely used and applied to almost any sedimentary rock containing a mixture of calcium and magnesium carbonate. Dolomite, in mineralogy, means a very definite rock containing $CaCO_3$ 54.35%, $MgCO_3$ 45.65%. Certain commercial deposits contain less than 1% of impurities. At the other end of the scale is calcite or calcium carbonate. In between are mixtures of calcite and dolomite carrying names such as high magnesium limestone, low magnesium limestone, high calcium limestone, etc., with no definite percentages to govern the names. More high calcium limestone is produced in this country than dolomite.

High grade dolomite is very constant in chemical composition. Of many cars shipped over many months, from one deposit the high, low and average are shown:

	CaO	MgO
High	30.61%	21.61%
Low	30.49%	21.42%
Average	30.54%	21.46%

To produce dolomite for the glass industry involves the usual quarrying, crushing, screening and drying procedures for raw stone, and the additional burning, picking, crushing and screening in the case of burned lime. Glass batch materials involve a considerable amount more of attention to detail, inspection and laboratory control than some of the other uses. One of the problems in the limestone industry is that of finding a place for each odd-sized piece of rock and the solving of this puzzle is an important part of providing glasshouse size at an economical price. "Fines", for example, now find a market in agriculture, rock dusting coal mines, asphalt pavement filler, neutralizer and filler for acid fertilizers, filler for rubber products, whiting, chicken grit and undercoating for automobile uses.

Burned lime is produced by burning 6″ to 12″ pieces of rock in a vertical kiln at temperatures of 1800° to 1900°F. The drawn lime is passed over a picking table where men break open each lump and pick out any kernel of unburned stone they may find. From there on it is a crushing and screening operation. Owing to the fragile nature of burned lime, it has not so far been found possible to do much about the distribution of the particle sizing. About all a producer can do is to put it through the topsize screen a customer wants, and that's it.

As burned lime will pick up CO_2 and moisture from the air, it cannot be stocked and quick handling while it is quite hot is desirable. This pick-up of moisture and CO_2, plus the CO_2 in any core the pickers may miss, is the "Loss on Ignition" that is carried in all specifications. While it is not a positive detriment to glassmaking, the customer is paying cost and freight on something of no use to him, and excessive Loss on Ignition as received at the plant can throw the batch out of balance. The present-day use of covered hopper cars and faster freight movement has been a big help in its control. It was not too long ago that a box car of glass lime in hot, humid weather would pick up 5 to 6% Loss on Ignition in a distance that is now 24 to 48 hours from kiln to batchhouse.

There seems to be no particular trend in the respective use of raw dolomite and burned dolomite. While individual companies change their usage from time to time, the changes balance out each other. The increase in usage of dolomite in glassmaking may be due to an increased production of glass.

Many glass manufacturers have adopted specifications for their dolomite requirements, and the process of working out specifications has always been very interesting. The glass technicians approach the problem from a theoretical or scientific background, backed up by experience in the problems of their own plants. The supplier, of course, has to balance his knowledge and experience with the limitations of his equipment and material and always with an eye to cost. A specification that no one can meet, or one resulting in a cost that no one can pay, is —well, it's just no good.

Control of Batch and Glass Compositions

By J. P. Poole
Brockway Glass Company, Brockway, Pa.

The ultimate in a batch and glass composition control program would be one which would assure that a consistently uniform glass of the desired composition was always delivered to the forming machine. How closely this ultimate must be approached for satisfactory operation depends on the process requirements, which in turn depend upon the specifications of acceptable ware.

There is no point in controlling much beyond the limit of stability of the forming operation itself as determined by the existing feeders and machines. Controlling to that point makes it possible to get the most out of the forming equipment. Machine changes can then be properly evaluated because the variability in the working properties of the glass has been eliminated. The end result of a control program is a stable operation permitting good reproducibility of job set-ups, simplified machine and feeder operation, and a higher, consistent per cent pack.

To end up with a glass of known composition, it is essential that the chemical and physical properties of the raw materials be known along with their expected variation. Specifications should be based on the knowledge of what changes can be tolerated without critically affecting the operation. Our own specifications are based on the amount of variation in each constituent of a given material which will change the density ± .0002 or the softening point ± .25°C. These specifications are not too difficult to meet as they amount to component variations of ± .3 to 5% for most materials.

After specifications are set, checks must be made and can range from a complete chemical and physical analysis of each car before unloading to spot checks of various cars. Sampling is important and back samples should be saved. Foreign cullet must be considered a material and its haphazard use will wreck an elaborate control system. With uniform raw materials assured, the next step is to make sure the desired weight of each material be obtained every time a batch is made. First, reliable scales are a necessity. The sensitivity of each scale should be reproducible to no less than .5% of the material weight. Routine checks for sensitivity, load and no-load balance should be made at least once a shift and standard weights up to the load point of the scales should be used. A record of the recorded total weight or individual scale records is essential.

A simple analysis check on the batch is desirable and the best mixing conditions (loading, speed, time, water content, grain size, etc.) should be determined. It is essential that the mixed batch be transported and fed to the furnace without demixing or segregation taking place. Unit batch systems are preferable but segregation can occur off the feeder itself. Storage bins give problems that are only partially solved by cellular or partitioned bins.

Once the batch is in the tank, practically all touch with it is lost until it comes out the other end as molten glass. It is this emergent glass that concerns us for this is the substance whose composition should be as predicted but often is not. To know the composition of this glass continually is the good toward which any control program is pointed.

Chemical analyses are too time-consuming to be of any use in aiding current operation, but are useful in confirming the results of other techniques of determining the compositions. The indirect method for rapidly determining glass composition is by the precise measurement of different physical properties of the unknown glass and by the calculation from these data of the glass composition which will satisfy all these properties simultaneously. The purpose of such measurements is to not only detect composition changes, but to be able to evaluate quantitatively what is responsible for the change. Such measurements must be fast and simple, have a small experimental error, be indicative of what is desired and be of properties whose dependence on composition is quantitatively known. Satisfactory properties are density (time rate of change), softening point log $\eta = 7.65$, annealing point log $\eta = 13.2$, strain point log $\eta = 14.6$, gob point log $\eta = 5.0$, flow point log $\eta = 3.0$, melting point log $\eta = 1.6$, index of refraction, coefficient of expansion, electrical conductivity or specific resistance, anelasticity, chemical durability, color, cord, and seed and blister count. The number and kind of properties to be measured depends upon the degree of control desired and the requirements of the finished glassware. It is often possible to determine one property indirectly by measurement of another which is dependent on the first but easier to measure.

There are some measurements that can be made on the finished glass which can be indicative of furnace behavior and operation. Cord, color, seeds and blister measurements are in this category.

To determine composition of the emergent glass from physical measurements data, it is necessary to know the changes occurring in the furnace during normal operation. The amount of alkali and other volatile constituents lost and the alumina pick-up from refractories must be known and can be calculated from a comparison of chemical analyses made over a long period of time with the expected composition based on the original batch.

To apply the simplest, two-measurement techniques graphically, curves are constructed of density and softening point vs. composition of each major oxide. These are made by calculating the change in density, softening point and composition resulting from a chosen overload and underload of each major ingredient. With separate curves for each material available, the change is found which will give the proper density and softening point and the composition read off the chart.

Beyond three measured variables, this technique becomes cumbersome so a matrix calculation is used. Briefly, the constants in the matrix equation are calculated, the results of the individual measurements introduced and the equation solved for each component.

Besides its function for control, such a program enables one to predict what changes would occur to the glass if various changes were made to the batch or process, intelligent formula changes to accomplish certain ends are possible, most of the guess work is eliminated from trouble shooting and most of the trouble shooting disappears anyhow.

Evaluation of Carloading Methods and Packages by Split Load Shipments

By John G. Turk

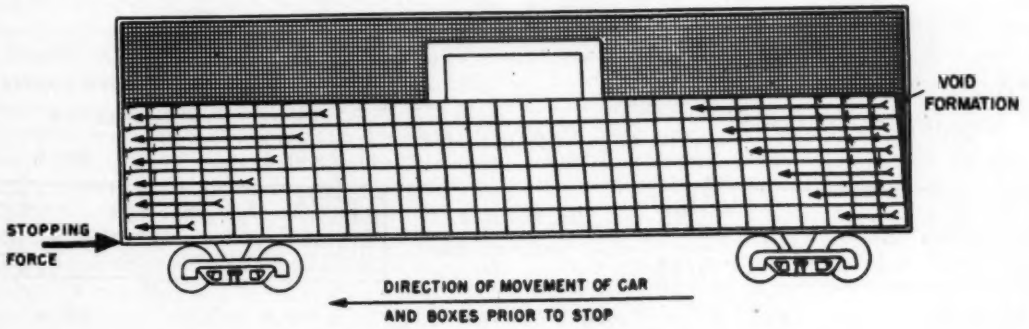
Glass Container Manufacturers Institute, New York, N.Y.

As a result of surveys and experimental shipments, one truth is immediately apparent: "The predominant damage force causing breakage of glass containers in rail shipments is the horizontal impact force directed lengthwise through the car." This statement is undoubtedly true for shipments of most types of case goods.

Figure 1 shows one set of conditions under which high horizontal impact forces may develop, and an illustration of their effect on the lading. An exactly opposite set of conditions applies when a car is accelerated rapidly as in switching or humping. Under these conditions, the boxes tend to stay still and the car tries to move with the result that the crushing forces are now on the right end and a void may develop on the left end. The car has now experienced a double shift—perhaps the most dangerous thing that can happen to lading. If boxes have fallen into the void prior to the second shift, a tragic damage picture may result.

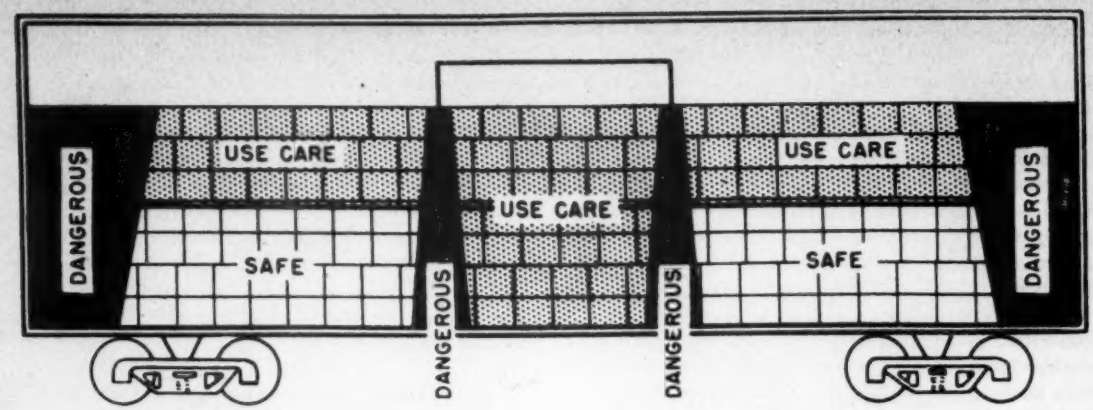
There are numerous types of forces that may develop in box cars, such as side sway and vertical forces, and these may contribute to box scuffing, label scuffing and minor breakage. However, it is emphasized that the predominant damage force is the horizontal force directed lengthwise of the car. Surveys have shown that the danger areas of a car are as given in Fig. 2.

The methods available for retarding, reducing and dissipating the horizontal lengthwise force are (1) material aids in loading and (2) the use of block plans of loading.



THE PREDOMINANT DAMAGE FORCE —— STOPPING CONDITIONS

Fig. 1.



DAMAGE AREAS IN TYPICAL CAR

Fig. 2.

Material Aids. End-wall cushioning is a very effective way to reduce these forces. Corrugated sheets, old boxes, mascurated paper pads or excelsior pads may be conveniently used. Surveys have all shown advantages for retaining paper interlaced through the load. In addition to the retarding action of the retaining paper, there is the advantage that boxes cannot fall into an end-wall void. Double shifts are not nearly as serious. Box cars with good wooden floors or with steel gripper type flooring should not have paper, board or pad covering. Pads may present an uneven base and paper and board may provide very little retarding action. Boxes should be kept out of doorway recesses by proper doorway protection.

Blocking Plans. Lengthwise staggering (offset) is incorporated into the load by turning crosswise alternate layers of end-wall stack. This is done only for the first stack. The remainder of the layer is straight-stowed, but the offset from the layer below so established continues throughout the block. A block may be ended at any stack by turning crosswise the proper alternate layer. The alternate lengthwise and crosswise stowing plan is a blocking and interlocking arrangement which consists of stacks of boxes arranged alternately lengthwise and crosswise.

Fundamentally, the cell arrangement of round bottles in their cases sets up inherent case dimensions which, when fully understood, can be utilized to advantage in building up bonded blocks from stable units. A unit, for this discussion, may be defined as an arrangement of cases, lengthwise and crosswise, which results in a stable square or rectangle that may be used as a unit of a bonded block.

The 2 x 3 unit results when two cases placed together lengthwise have a total dimension equal to three cases placed together crosswise. This is a fundamental arrangement which depends on the number of bottles involved and has no relation to the number of such units which may be eventually worked into a bonded block. It is inherently true that six round bottles occupying lengthwise rows in two cases are equal to six round bottles occupying crosswise rows in three cases (there will be one negligible thickness of corrugated board difference in the two directions).

The 3 x 4 unit results when three cases placed together lengthwise have a total dimension equal to four cases placed together crosswise. This, again, is a fundamental arrangement.

Some other factors useful in retarding the forces are: (1) glued loads, (2) floating top layers, (3) steel strapped bonded blocks, (4) snug crosswise load, (5) snug lengthwise load, (6) vertical corrugated divider sheets and (7) floating bulkheads.

By adopting controlled experimental shipments using the split load technique, the shipper can evaluate which of these many material aids and carloading methods he should use. In this procedure, the loading of the car is split lengthwise of the car in such a way that the right side of the car is loaded with the standard package (or loading methods, end-wall cushioning, bracing, blocking, etc.) and the left side of the car is loaded with the experimental package (or loading method, etc.) to be compared with the standard. See Fig. 3.

The controlled test shipment may be used to study

(*Continued on page* 220)

CONTROLLED SHIPPING TESTS USING SPLIT LOAD
EXAMPLE OF STOWING IN END ZONES FOR COMPARISON OF TWO PACKAGES

Fig. 3.

Inventions and Inventors

Glass Compositions

Acid Resistant Water-Glass. Patent No. 2,662,022. Filed November 25, 1950. Issued December 8, 1953. No sheets of drawings. Assigned to Farbwerke Hoechst Aktlengesellschaft vormals Meister Lucius und Bruning by Karl Dietz.

The present invention relates to self-hardening water-glass compositions which are highly acid resistant. The following example serves to illustrate the invention:

Ninety parts of quartz powder of suitable fineness of grain, with a residue of 10-25 per cent on a 10,000 mesh sieve, 4 parts of clay and 2.5 parts of an active silicic acid, i.e. a silicic acid of an especially high reactivity with alkali lyes even in the cold, are mixed with 3.5 parts of glycolide. 100 g. of this cement powder are mixed with 30 cc. of a potassium silicate solution in which the ratio of SiO_2 to K_2O is about 1.64 and that of SiO_2 to H_2O is about 0.46. The viscosity of the water-glass solution is 80 centipoises at 20°C. After about 20 minutes, the composition begins to harden and at ordinary temperature the setting is completed after 3 days.

The patent contains 7 claims and the following references were cited: 1,832,752, Thoretz, Nov. 17, 1931; 2,069,486, Tilden, Feb. 2, 1937; 2,206,046, Pollard, July 2, 1940; 2,492,790, Farkas, Dec. 27, 1949; 108,685, Australia, Sept. 28, 1939; 108,687, Australia, Sept. 28, 1939; 723,584, Germany, Aug. 6, 1942; 256,258, Great Britain, Mar. 10, 1927; and 551,408, Great Britain, Feb. 22, 1943.

Sheet and Plate Glass

Improved Grinding Media. Patent No. 2,658,317. Filed February 23, 1951. Issued November 10, 1953. No sheets of drawings. Assigned to Libbey-Owens-Ford Glass Company by Willard L. Morgan.

This invention relates broadly to a process of working glass and is more particularly concerned with the grinding of the edges of the glass or the grinding of surfaces of glass in which some surfaces are being worked upon while others are not. It is further concerned with such operations wherein a cooling fluid, such as water and emulsified oil, is applied to the edging wheels or grinding tools during such work.

It has been found that high-speed production machines may be run by the addition of an acid reacting material, such as boric acid, to the system in which the cooling fluid recirculates. The boric acid reacts with any alkaline condition present in the coolant and reduces the same or creates a slight acid condition, either of which results in cooling fluids which do not etch glass surfaces. Boric acid is particularly effective for this purpose in that, unlike some other acids, it may be added in excessive quantities without any effect upon the glass surfaces or the machines.

Phenolphthalein is added to the coolant in the form of an alcoholic aqueous solution such as 1% solution in 50% alcohol and, if the solution is harmfully alkaline, it will be indicated to the operator by the solution turning a bright red color. In the presence of excess or free boric acid, the red color from the phenolphthalein is destroyed and the solution becomes colorless. Thus, the operator of the machine is automatically told by the development of the pink color when to add more boric acid to the operation.

The patent contains 8 claims and the following references were given: 2,366,825, Adams, Jan. 9, 1945; 2,387,142, Fruth, Oct. 16, 1945; and 2,390,405, Walker, Dec. 4, 1945.

Bulb-Edge Glass-Cutting Mechanism. Fig. 1. Patent No. 2,659,148. Filed March 9, 1951. Issued November 17, 1953. Two sheets of drawings. Assigned to American Window Glass Company by Louis Giulioli and Thomas A. Insolio.

The primary object of the invention is to provide a bulb-edge glass-cutting mechanism that will cut or score a line on a moving glass sheet which is always a fixed distance from the edge of the glass sheet. A transmitter or sensing means is provided having a member that follows the position of the bulb-edge of the glass sheet, and controls the position of a glass cutter so that the latter follows the movement of the member and hence of the bulb-edge.

In operation, as shown in Fig. 1, the glass cutter 84 is pressed against the face of the glass sheet 12 at a distance from the bulb-edge determined by the spacing between it and the guide wheel 86. The guide wheel bears against the edge of the bulb-edge 14 because of the tension in the spring 100 which tends to move or press the slide bar 78 toward the lever bar 72, the movement of the slide bar 78 causing the pivot bar 92 to pivot about its relatively fixed pivot 96.

The patent contains one claim and the following references were cited: 1,807,619, Boush, June 2, 1931; 2,230,651, Morris, Feb. 4, 1941; 2,310,182, Munschauer, Feb. 2, 1943; and 2,542,473, Bullman et al., Feb. 20, 1951.

Safety Glass for Aircraft. Fig. 2. Patent No. 2,659,686. Filed February 13, 1950. Issued November 17, 1953. One sheet of drawings. Assigned to Libbey-Owens-Ford Glass Company by George B. Watkins.

It is the aim of this invention to provide an improved laminated safety glass structure of the reinforced extended plastic type which will resist severe thrust of

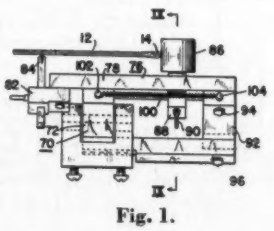


Fig. 1.

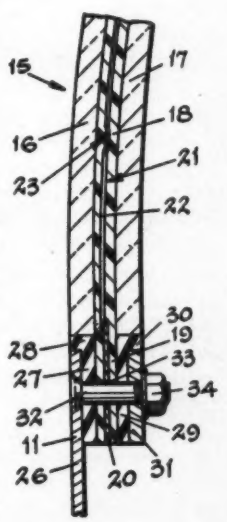


Fig. 2.

pressure in both directions, either from the interior or exterior of an airplane, to firmly retain the structure in place against forcible displacement.

The laminated glass 15, as shown in cross section in Fig. 2, is composed of two sheets of glass 16 and 17 and an interposed sheet of thermoplastic material 18 such as, for example, polyvinyl butyral resin. The area of the plastic interlayer 18 is greater than the areas of the glass sheets and extends beyond their marginal edges to provide a continuous, flexible attaching or mounting flange 19. Embedded in the extended attaching flange 19 is a metal reinforcement that may consist of a one-piece metal band 20 or may be formed of a plurality of separate strips. The band 20 preferably extends from the outer edge of the plastic flange 19 to a point slightly inwardly of the edges of the glass sheets 16 and 17. The metal reinforcement or band 20 serves to increase the strength and stability of the laminated glass unit and particularly the extended flange 19 so that the danger of tearing or shearing of the plastic flange is substantially minimized.

With such an arrangement, excessive air pressures exerted upon the laminated unit from either within or outside the plane, or the shock of accidental collision with flying birds or other objects, will be carried or absorbed by the wire grid or network 21 and not imposed entirely upon the extended attaching flange 19 of the plastic interlayer 18. As a result, accidental or forcible displacement of the laminated glass unit 15, from its installed position, will be effectively prevented.

The patent contains four claims and the following references were cited: 1,327,281, Jenkins, Jan. 6, 1920; 1,632, Bull, June 14, 1927; 2,028,670, Hosking, Jan. 21, 1936; 2,121,777, Bailey, June 28, 1938; 2,222,742, Ducret, Nov. 266, 1940; 2,322,582, Marini, June 22, 1943; 2,382,956, Boicey, Aug. 21, 1945; and 2,490,433, Gunning, Dec. 6, 1949.

Polishing Glass. Fig. 3. Patent No. 2,661,581. Filed July 18, 1947. Issued December 8, 1953. Two sheets of drawings. Assigned Societe Anonyme des Manufacture des Glaces & Produits Chimiques De Saint-Gobain by Philippe Tommy Martin.

This invention has for its object to provide such an arrangement of identical polishing units that they collectively will act with substantial uniformity on a strip of glass moving below. In Fig. 3 the desired compensation of the work performed is obtained by two successive units of two frames each the centers b′, c′, b^2, c^2, etc. of the frames carried by each beam are at different distances D - - d from the axis x - - x so that the pivots of the two frames are asymmetrical to the axis. The asymmetry is reversed as between adjacent pairs and the distances D - - d etc. of each pair of frames or unit is such that the maxima of the work performed by one unit correspond to the minima of the work performed by the other unit.

The pads, on the rotation of their carrying frames and polishing heads, overhang at times the edges of the strip as is shown. To facilitate the scraping of the abrasive, they are of annular form having a cut-out center e, E, the diameter of which depends upon the overhang of its head. Thus each pad on its rotation in moving back to a position entirely over the glass strip will be entirely scraped by the edge of the sheet. The annular pads thus have the advantage of being automatically cleaned by their scraping on the edges of the strip glass when they overhang them.

The patent contains 30 claims and 10 references are given.

Tube and Cane Machines

Size Control of Glass Tubing. Fig. 4. Patent No. 2,659,182. Filed October 23, 1947. Issued November 17, 1953. Four sheets of drawings. Assigned to Corning Glass Works by Leroy C. Argyle.

An improved method of drawing glass tubing from a molten supply of glass is illustrated in Fig. 4. The method is modified after that given in Patent No. 2,085,-245 granted to William J. Woods, June 29, 1937, wherein the tubing is drawn upward from a molten supply of glass and compressed air is supplied to the bore as needed to maintain a desired cross-sectional diameter.

The support 43 has mounted micrometers 51-54 arranged in operative relation with switch members 31-34, and so adjusted that when tubing below a predetermined maximum diameter passes between rollers 11 and 12, the micrometer 54 will engage switch member 34 and break a circuit between it and the associated contact carried by member 40. Micrometers 53, 52 and 51

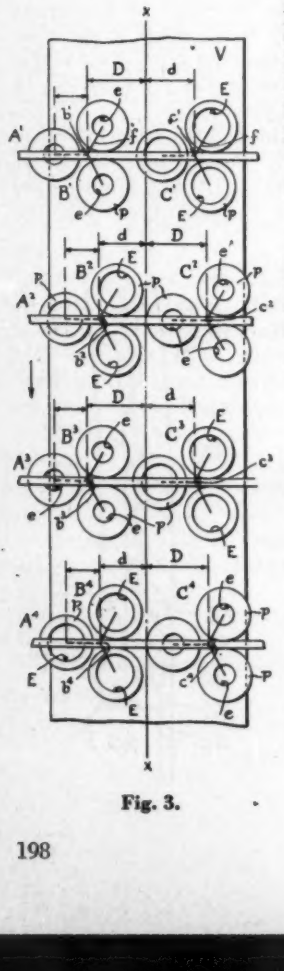


Fig. 3.

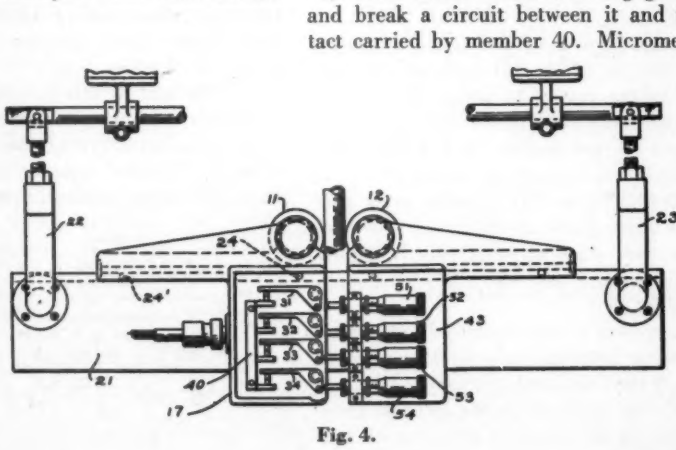


Fig. 4.

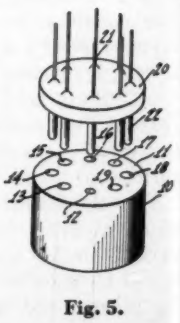


Fig. 5.

are adjusted to operate the switches associated with them as tubing of progressively smaller diameters passes between rollers 11 and 12. The means for maintaining the rollers 11 and 12 in engagement with the tubing, irrespective of its size, comprises a Y-toggle 55 and a cooperative weight 56, not shown in the diagram.

The control apparatus may also be employed in combination with the heat control to the furnace in order to regulate the viscosity of the glass.

The patent contains 7 claims and 14 references were given.

Processing Electron Tubes. Fig. 5. Patent No. 2,660,004. Filed June 28, 1950. Issued November 24, 1953. One sheet of drawings. Assigned to Radio Corporation of America by Charles W. Daley.

This invention relates to a novel support fixture for supporting a pronged structure, and more particularly concerns a head or pin for supporting an electron tube component, such as a flat glass stem having lead-ins extending therefrom, on an apparatus for processing electron tubes.

According to the invention, the pin as shown in Fig. 5 is provided with a plurality of bores extending downwardly from an upper surface and disposed in a predetermined array, so that when the prongs 22 of the stem 20 are in registry with the bores, only one of the prongs is coaxial with a bore 12. The other bores 13 to 19, inclusive, are appreciably wider than the prongs and are arranged in such a manner that the prongs 22, other than the prong entering bore 12, are in registry with portions of the bores adjacent the inner edge of the array. Thus, while the bores 13 to 19 are seemingly wide enough to permit free play of prongs, such free play is permitted only prior to engagement of all the prongs with all the bores in the pin. After this engagement is completed, the stem is held in a predetermined fixed position on the pin with no play permitted between the prongs and the walls of the bores. The pin of the invention therefore permits a loading operation of positive steps requiring no repetition for trial purposes. Once a suitable sequence of steps has been learned by an operator, the loading of a stem on a pin can be accomplished quickly and with a minimum of fatigue on the part of the operator.

The patent contains six claims and the following references were cited: 2,203,917, Malloy, June 11, 1940; 2,321,600, Horn, June 15, 1943; 2,337,055, Mathias, et al., Dec. 21, 1943; 2,454,834, Powers, Nov. 30, 1948; and 481,940, Great Britain, Mar. 16, 1938.

Sealing of Radio Tubes. Patent No. 2,661,576. Filed December 24, 1946. Issued December 8, 1953. Three sheets of drawings (none reproduced). Assigned to Sylvania Electric Products, Inc. by Stanley J. Gartner.

In the manufacture of radio tubes, automatic sealing mechanism is quite important. A new and useful chuck is shown. The improved form of chuck grips brittle articles with a minimum of impact. The chucks are operated in pairs in order that they may grip a pair of assembled parts with the supporting and operating mechanism of both chucks located at the same end of the parts assembly. The chuck jaws are interposed in the path of the flames without impairing the uniform heating of the parts gripped.

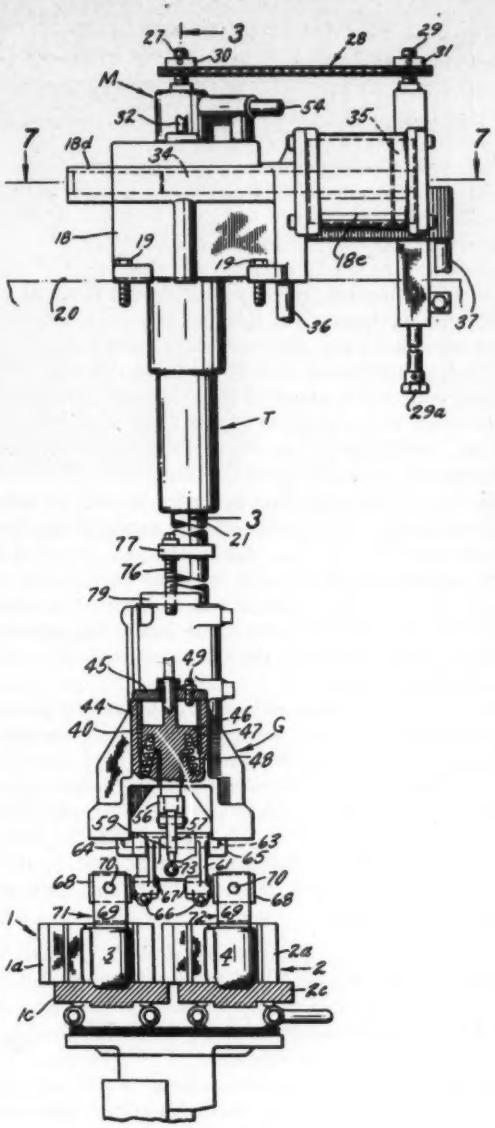


Fig. 6.

A full understanding of the advantageous features of the apparatus can be had only after a study of the many drawings.

The patent contains 5 claims and 10 references were cited.

Miscellaneous Processes

Take-out Apparatus for Bottle Machines. Fig. 6. Patent No. 2,660,831. Filed February 1, 1950. Issued December 1, 1953. Three sheets of drawings. Assigned to Emhart Manufacturing Company by George E. Rowe.

The principal object of the present invention is to provide improved take-out equipment, the operation of which provides for a longer cooling time on the dead-plate without increasing the length of the over-all forming cycle.

As the blow mold sections 1a, 1b, 2a and 2b shown in Fig. 6 open and leave the jars 3 and 4 supported on their respective bottom plates 1c and 2c, operating air is supplied from the timer (not shown) to move the

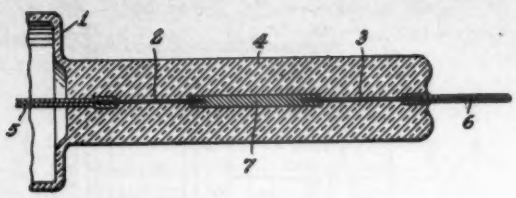


Fig. 7.

piston 35 to the left, thereby rotating the shaft 21 and pivoting the gripper G so that the two pairs of gripper plates 71 and 72 are disposed on opposite sides of jars 3 and 4. Immediately thereafter, bottom plates 1c and 2c drop and air is supplied by the timer through line 36 to force the piston 35 to the right and swing the gripped jars to positions above their respective dead-plate stations. It will be seen that the immediate removal of the jars from their bottom plates 1c and 2c makes the blow molds 1 and 2 immediately available for forming the next pair of jars. While the jars 3 and 4 are being moved to and held in elevated position by the gripper device G, the wiper or transfer arms T are actuated by the rotating cam 16 and the jars of the preceding cycle are wiped from the dead-plate stations 5a and 6a onto the conveyor 7.

The invention has the advantage of providing substantially greater effective cooling for the ware during a maximum portion of the complete cycle.

The patent contains 10 claims and the following references were cited: 1,921,390, Ingle, Aug. 8, 1933; 1,947,610, McNamara, Feb. 20, 1934; 2,081,859, Peiler, et al., May 25 1937; 2,182,167, Berthold, Dec. 5, 1939; 2,253,155, Wadman, et al., Aug. 19, 1941; and 2,556,469, Dahms, June 12 1951.

Method of Making Quartz-to-Metal Seals. Patent No. 2,659,964. Filed August 30, 1948. Issued November 24, 1953. One sheet of drawings (none reproduced). Assigned to General Electric Company by Ernest Benjamin Power and Evan Herbert Nelson.

A method of making quartz-to-metal seals in a high pressure gas-filled discharge lamp is described. The stout conductor is held within a first tube of the vitreous quartz so that one end of the conductor projects through a hole in the thin disc which abuts against the end of the tube, which end may be flanged. A second tube of quartz, of appreciably greater diameter than the conductor, is then placed over the projecting end of the conductor. The opposed ends of the two tubes, which are shaped to fit for the sealing, are united by heating so as to embed the edge of the thin disc, but so that the second tube does not collapse onto the conductor. The soldering or brazing metal is then applied to the disc through the annular space between the conductor and the inner wall of the second tube. The metal is preferably applied in solid form, the soldering or brazing being effected by subsequent heating of the body.

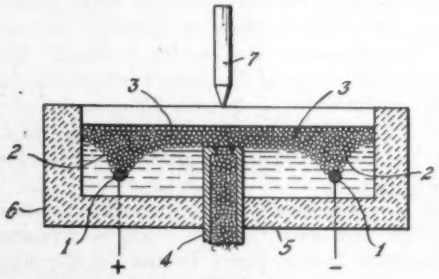


Fig. 8.

The patent contains 2 claims and 15 references were cited.

Glass-to-Metal Seal. Fig. 7. Patent No. 2,659,183. Filed November 13, 1950. Issued November 17, 1953. One sheet of drawings. Assigned to Hanovia Chemical & Manufacturing Company by William T. Anderson, Jr.

An object of the invention is to provide new and improved seals in vitreous materials, such as glass, quartz and the like, for metal conductors, which seals are completely vacuum-tight

During operation of the device as shown in Fig. 7, the quartz or glassy material 4 remains cooler than the metal components of the lead-in conductor, and although the heavy foil 7 is not sealed vacuum-tight into the quartz, it does become cooled by contact with the quartz. Furthermore, because of its relatively large mass, the heavy foil 7 does not become heated as does a thin foil from the passage of electric current. For these reasons the heavy foil 7 acts to cool the thin foil 2, but what is of most importance is the fact that the heavy foil prevents the thin foil 3 from becoming heated to a degree where oxidation at the air junction of the foil 3 could occur. The operating temperature of the thin foil 3 remains substantially lower than would be the case if the portions 2, 7 and 3 constituted one continuous thin foil.

The patent contains 2 claims and the following references were given: 2,138,224, Barasch, Nov. 29, 1938; 2,159,794, Hagen, May 23, 1939; 2,190,302, Waldschmidt, Feb. 13, 1940; 2,200,939, Trebbin, May 14, 1940; 2,215,300, Ryde, Sept. 17, 1940; 2,231,459, Anderson, Feb. 11, 1941; 2,405,089, Craig, July 30, 1946; 476,488, Great Britain, Dec. 6, 1937; and 525,772, Great Britain, Sept. 4, 1940.

Manufacture of Multicellular Glass. Fig. 8. Patent No. 2,658,096. Filed March 4, 1946. Issued November 3, 1953. One sheet of drawings. Assigned to Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain by Ivan Peyches.

This invention refers to apparatus for the manufacture of multicellular glass. Bubbles are formed in the glass by overheating in the neighborhood of a surface immersed in it.

In Fig. 8, numeral 1 indicates electrodes of small diameter for heating the glass by Joule effect in the mass. The bubbly glass 2, produced by overheating of the bath in contact with the electrodes, rises in the surrounding mass and gathers in the upper part 3 of the zone which is hatched on the figure. It then flows into a vertical tube 4 which penetrates through the bottom 5 of the tank 6 and opens under the free surface of the bath, in the upper part where the bubbly glass gathers. Such withdrawal tube may be regulated by a suitable device 7, able by adjustment to control or to stop the flow of the bubbly glass.

Other methods of obtaining overheating may be used, such as resistors or flame tubes. Other modifications can be made in which certain electrodes are used for

(*Continued on page* 212)

SILICONE COATING REDUCES BREAKAGE BROCKWAY FULL-SCALE TEST SHOWS

More rugged, more attractive glass containers are now commercially practicable as a result of a silicone coating process disclosed for the first time March 31 by its developers, Brockway Glass Company and General Electric Company. Substantial reductions in breakage have been demonstrated at many points of handling between manufacture and consumer use, it was disclosed.

In a statement covering development work commencing early in 1952, F. B. Hess, Brockway Vice President, and E. G. Tajkowski, of GE, reported on six months commercial use of a process coating the inside and outside of catsup, baby food and grape juice containers with a new silicone emulsion known as SM-70.

A silicone mist is applied to the newly-made glass container in the annealing lehr. In addition to making the package scratch-resistant and easy to empty, the process is said to give the ware a more glossy appearance and a better "feel". All this is accomplished without imparting an oily film or any harmful toxic characteristics, Mr. Tajkowski stated.

The prime advantage of breakage reduction was stated in these terms: coated bottles on the filling line showed breakage of 0.014 per cent, compared with an uncoated figure of 0.1 to 0.3 per cent; an 11-inch drop test gave a 7 per cent loss contrasted with 51 per cent for uncoated containers. Shipment losses covering 22,000 cases of siliconed bottles were put at 0.00017 per cent against a normal rate quoted at 0.5 per cent.

Siliconed bottles were also said to be 15.5 per cent stronger in heel impact tests and 28 per cent stronger under internal pressure. For these reasons, the GE engineers explained, silicone coating would produce more reliable single-trip and lighter weight returnable bottles.

Using a reported half gram of silicone for a gross of 5-ounce jars, the treatment costs about three-quarters of a cent. Larger bottles used in the tests showed costs of about one cent a gross.

Economies involved in the use of silicones include: the versatile chemical can be readily cured on glass surfaces at low temperatures. Further, the coating may be applied by simple means in the annealing lehr. The coating is relatively low in cost. For example, it was stated that only ½ gm of silicone is required to coat a gross of 5-ounce bottles.

The G-E engineers predicted silicone applications to flat glass, chinaware and ceramic insulators. The idea for silicone coating was first conceived in 1952 when Brockway approached GE with the thought in mind to develop such a coating. In the intervening months, GE developed its emulsion, the two firms worked out the coating method and conducted tests at the glass plant in Brockway, Pa., and in the plants of packers whose names were not disclosed.

CRYSTAL CHEMISTRY SYMPOSIA

The seventh Crystal Chemistry Sumposium is scheduled to be held June 4, 1954 at the School of Ceramics, Rutgers University, New Brunswick, New Jersey.

The program will be announced later. Dr. H. T. Smyth of the Rutgers School of Ceramics will be Chairman. This year Rutgers plans to devote the program to the properties of various forms of silica.

R. L. CHENEY TRANSFERS TO NEW YORK OFFICE OF G.C.M.I.

Richard L. Cheney has just been appointed Director of the new Market Research and Promotion Division of the Glass Container Manufacturers Institute, Inc., according to Victor L. Hall, General Manager. Mr. Cheney has been West Coast Manager for the Institute, with offices in San Francisco, for many years.

A graduate of the Massachusettts Institute of Technology, Mr. Cheney has had wide experience in business research, marketing, sales, sales promotion and general trade association management. For ten years he was associated with a leading manufacturer of food processing machinery and for two years was in charge of packaging for one of the country's largest food chains.

The new Division of G.C.M.I. will concentrate, for the present, on a broad study of the market problems and opportunities of the glass container industry.

Named to succeed Mr. Cheney as West Coast Manager of the Institute is Frank H. Wright, who had been Assistant West Coast Manager. Mr. Wright was formerly a sales executive for TWA Air Lines.

LETTER TO THE EDITOR

Editor
The Glass Industry

Dear Sir:

We deeply appreciate the insertion of the feature article, "Good Housekeeping Improves Efficiency and Morale at Mississippi Glass," which appears in the March 1954 issue of THE GLASS INDUSTRY and which was submitted by the writer. However, we note an error in the next to last paragraph on Page 128 which is obviously a typographical error and which causes the statement to be misleading.

Specifically, the sentence reading, "It is not the intention of top management *for* plant management to become complacent and drift into the old bad habits." This should have read, "It is not the intention of top management *or* plant management to become complacent and drift into the old bad habits."

We again thank you for the opportunity to present the results of our Good Housekeeping Program and trust the above correction will serve to rectify the misstatement.

Sincerely yours,
John A. Mazzoni, Manager

CHAS. TAYLOR ELECTS OFFICERS

National Lead Company has announced the appointment of the following officers of its wholly-owned subsidiary, The Chas. Taylor Sons Company: Robert W. Knauft, President; M. C. Booze, Vice President; L. J. Woodcock, Treasurer; and J. B. Henrich, Secretary.

A Study of the Reaction Rates Between Silica, Alumina, Mullite, Zirconia and Other Oxides at Various Temperatures

Abd-El-Moneim Abou-El-Azm, in the December 1953 issue of the *Journal of the Society of Glass Technology*, reports on the results of additional work on reactions between silica and other oxides. The present work was concerned with further studies of a few binary and ternary mixtures, the purpose of which was to throw further light on some of the results already published investigating the effect of (1) the particle size of the silica and (2) the form in which the silica is introduced and its rate of reaction with other metallic oxides. Another part of the work consisted of a study of the reactions between alumina, mullite or zirconia with one or more of the other metallic oxides. Such reactions are of importance in the glass industry, since they will determine the rates at which alumina-silicate refractories and refractories containing zirconia will be attacked by batch materials and glass. The extent of the glass-forming reaction was measured in all cases by the X-ray diffraction method.

It had been previously shown that silica reacts at a higher rate with lime than with magnesia, both in the presence and in the absence of an alkali-metal oxide. The lime was introduced in those mixtures as calcium carbonate, while the magnesia was introduced as magnesium oxide. It was suggested that this difference in form could account for the differences found. Measurements were therefore made on mixtures in which the lime was introduced as the oxide. The results, when compared with those obtained from mixtures in which the lime was introduced as the carbonate, showed that the reaction rates in the silica-lime-soda and silica-lime-potash mixtures are independent of the form in which the lime is introduced.

With silica-alumina-soda and silica-zirconia-soda mixtures the results showed that: (1) in the initial stages of firing, the presence of either alumina or zirconia decreases the rate of reaction with silica; (2) after a certain period of firing (3 hours in the mixture containing alumina and 5 hours in the mixture containing zirconia), the reaction rates are higher than in the simple silica-soda-mixture.

In the experiments made to measure the effect of particle size of the silica on its reaction rates with soda, studies were made of the reaction rates in the mixture SiO_2 75, Na_2O 25 per cent, in which silica was introduced in the form of sand particles of specific grain sizes; namely, 0.423, 0.256, 0.179, 0.156 and 0.126 mm. mean diameter. The reactions rates were measured at 700°, 800°, 900°, 1000° and 1050°C. It was found that the reactions at 700°, 800° and 900° could be represented by the equation.

$$R\left[1-\left(\frac{m}{M}\right)^{\frac{1}{3}}\right]\log a = \log t + \text{constant} \qquad (1)$$

and at 1000° and 1050° by the equation

$$1-\left(\frac{m}{M}\right)^{\frac{1}{3}} = Bt \qquad (2)$$

where R = the original radius of a silica particle;
M = the mass of silica introduced originally in the mixture;
m = the mass of unaltered silica after firing the mixture for t seconds;
a = a factor which depends upon the temperature of firing and is constant for a given mixture at a constant temperature;
and
B = a constant for a given mixture at a constant temperature.

The value of a for reactions at 700°, 800° and 900° increases with the increase of the particle size of the silica and the value of B decreases with the increase of the particle size of the silica. The relation between log B and log 1/R is linear at 1050° but curved at 1000°, which can be taken as an indication that the thickness of the glassy layer formed during the interaction between silica and soda was zero or practically zero at 1050°, and increased to a finite but eventually constant value at 1000°.

The results on the effect of the form in which the silica is introduced showed that: (1) at 1200° and 1300° cristobalite reacts with either soda or potash at a higher rate than quartz; (2) at 1400° and 1450° the rate at which cristobalite reacts with soda or potash is almost identical with that of quartz, although at 1450° the quartz seems to react with soda at a very slightly higher rate than cristobalite, though the differences are within the limits of probable experimental error.

The results obtained from the study of the reactions between alumina and other oxides showed that:

(1) In alumina-alkali, alumina-lime, alumina-lime-alkali and alumina-boric oxide mixtures, the extent of the glass-forming reactions is negligibly small in the range between 900° and 1400°, as compared with the reactions between silica and the alkalis, lime or boric oxide.

(2) The addition of silica gel or boric oxide to alumina-alkali and alumina-lime-alkali mixtures increased the reaction rates very considerably, the increase being greater when boric oxide was added than with the addition of silica.

The greater increase in the reaction rates in the alumina-boric oxide-soda mixture than in the corresponding alumina-silica-soda mixtures may be attributed to the higher fluidity of the glasses containing boric oxide and possibly also to a difference between the bond strengths of the alkali-silica glasses and the alkali-borate glasses.

(3) The replacement of part of the silica or boric oxide by soda in alumina-silica-soda or alumina-boric oxide-soda mixtures respectively increased the reaction rates.

(4) The introduction of the part of the soda as sodium fluoride in alumina-boric oxide-soda, alumina-boric oxide-lime-soda, and alumina-silica-lime-soda mixtures decreased the rates of reaction with alumina. Also the introduction of part of the lime as calcium fluoride in alumina-boric oxide-lime and alumina-silica-lime-soda mixtures decreased the reaction rates. The lower melting point of calcium fluoride (1360°) as compared with that of calcium oxide (2570°) would have suggested that the reaction rates would increase when part of the lime was introduced as calcium fluoride. To some extent this may be attributed to loss of silicon fluoride and boron fluoride, which would cause the alumina-silica and alumina-boric oxide ratios to increase, with consequent reduction in the reaction rates. The effect was, however, small.

(5) The introduction of boric oxide in the form of boric acid increased the reaction rates with alumina as compared with the reaction rates when the B_2O_3 was introduced as boric oxide. The effect may be due to the molecular state of subdivision of the B_2O_3 when boric acid is recomposed, and also possibly to the water taking part in the initial stages of the reaction.

(6) The addition of ferric oxide equivalent to 2 per cent FeO to the alumina-silica-lime-soda mixture increased the reaction rates, while the addition of 2 per cent of titanium dioxide to the above mixture did not affect the reaction rates. This would be understood when it is realized that alumina and ferrous oxide form a eutectic (5 per cent FeO, 95 per cent Al_2O_3) which melts at 1300° while the alumina-titania eutectics melt at temperatures higher than 1700°.

(7) The various alkali-metal oxides, arranged in order of decreasing rates of reaction with alumina in the presence of silica or boric oxide, could be placed as follows: K_2O, Na_2O, Li_2O when they are present in molecularly equivalent amounts.

(8) In the alumina-lime-boric oxide mixtures (cobalt glasses), it was noticed that: (a) the replacement of part of the alumina by boric oxide or lime increased the reaction rates; (b) the replacement of part of the lime by boric oxide increased the reaction rates; (c) when part of the lime is replaced by an equivalent amount of an alkali-metal oxide, the reaction rates increased considerably, the increase being greatest with potash and least with lithia; (d) the replacement of part of the boric oxide with soda increased the reaction rates, but not to the same extent as when part of the lime was replaced by soda; (e) the various alkaline-earth oxides, arranged in order of decreasing rates of reaction with alumina, can be placed as follows: BaO, CaO, ZnO, MgO, i. e., the reaction rates increased with the increase of the cation volume.

(9) In all the reactions between alumina and the other oxides, their progress could be represented by either equation (1) or equation (2) depending upon the firing temperature and the composition of the mixtures. Intermediate cases between these two equations also existed.

In the reactions which could be represented by equation (1), the value of the factor a decreased with the increase of the reaction rates, which is parallel with the results obtained for the reactions between silica and other oxides.

The results obtained from the study of the reactions between mullite and other oxides showed that:

(1) The reactions between mullite and the alkalis, lime or boric oxide are much less rapid than the reactions in corresponding mixtures containing silica, but faster than the reactions in the mixtures containing alumina.

(2) The addition of part of the soda or lime in the form of the respective fluorides increased the rate of reaction with mullite. This can be attributed to the fluorides causing an increase in the rate of decomposition of the mullite and also reacting rapidly with the silica thus liberated, the final effect of which would be to increase the rate of combination of the alkalis, lime and boric oxide with the alumina liberated when the mullite breaks down.

(3) The introduction of boric oxide or silica gel increased the rate of reaction between mullite and the alkalis or lime. This, again, was not unexpected because boric oxide or silica increase the rate of reaction between alumina and the alkalis or the lime.

(4) Boric acid reactions with mullite proceed at a higher rate than the reactions with boric oxide and mullite.

(5) The various alkalis and alkaline earths, arranged in order of decreasing rates of reaction with mullite, can be placed as follows: K_2O, Na_2O, Li_2O, and BaO, CaO, ZnO and MgO respectively, when they are present in molecularly equivalent amounts.

(6) Additions of ferric oxide equivalent to 2 per cent FeO, or of 2 per cent titanium dioxide, increase the reaction rates in mullite-silica-lime-soda mixtures. This may be attributed to the formation of eutectics, which melt at comparatively low temperatures, and also because ferrous oxide or titania both produce a significant reduction in the viscosity of silicate glasses.

(7) The progress of the reactions between mullite and the other oxides could be represented by equations (1) or (2), depending upon the temperature of firing and the composition of the mixtures; intermediate cases also existed. In the reactions which could be represented by equation (1), the factor a decreased with the increase of the reaction rates.

In the case of reactions between zirconia and other oxides the results showed:

(1) The reactions between zirconia and the alkalis and lime are much slower than the reactions between silica or mullite and the alkalis and lime, but faster than the reactions between alumina and the alkalis and lime. This can be explained when it is recalled that alumina cannot be a glass former by itself, while zirconia is a glass former. On the other hand, the Zr-O-Zr bonds are considerably stronger than the corresponding silica bonds, as indicated by the fact that the dissociation energies E_d per gram-molecule are 485 and 424 k. cal. for zirconia and silica respectively.

(2) The introduction of part of the soda as sodium fluoride in the zirconia-soda mixture does not affect the reaction rates.

(3) The addition of silica gel or boric oxide to a zirconia-alkali mixture increases the reaction rates considerably. This suggests that when the reaction between the alkalis and the silica has resulted in the formation of an alkali-silica glass, any "break" which occurs between two adjoining silicon tetrahedra can be filled by a

(*Continued on page* 224)

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during January 1954 was as follows: *Flat Glass:* 30,500 persons were employed in the flat glass segment of the glass industry. This is a drop of 4.4 per cent from the 31,900 employed during December 1953. *Glass and Glassware, Pressed and Blown:* During January, preliminary employment was 82,400 persons. Compared with the previous month's adjusted figure of 87,600, a drop of 5.8 per cent is shown. *Glass Products Made of Purchased Glass:* A preliminary employment figure of 13,100 persons was reported for January 1954. This is a drop of 3.6 per cent from the December 1953 adjusted employment of 13,600.

Payrolls in the glass industry during January 1954 were: *Flat Glass:* A preliminary payroll figure of $12,633,812 was reported for January, or 7.1 per cent below the adjusted $13,604,925 paid out during December 1953. *Glass and Glassware, Pressed and Blown:* $24,648,312 was the preliminary figure reported for payrolls during January 1954. This is 6.3 per cent less than the adjusted $26,321,464 reported for December 1953. *Glass Products Made of Purchased Glass:* Preliminary payrolls for January were $3,351,504. Compared with December 1953 payrolls of an adjusted $3,609,077, a drop of 7.1 per cent is shown.

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

	February, 1954
Narrow Neck Containers	
Foods	778,342
Medicinal & Health Supplies	1,031,489
Chemicals, Household & Industrial	738,140
Beverages, Returnable	307,799
Beverages, Non-returnable	41,665
Beer, Returnable	109,477
Beer, Non-returnable	439,495
Liquors	601,114
Wines	308,155
Toiletries & Cosmetics	495,934
Sub-total (Narrow)	4,851,610
Wide Mouth Containers	
Foods	*2,587,655
Dairy Products	157,113
Medicinal & Health Supplies	360,391
Chemicals, Household & Industrial	150,861
Toiletries & Cosmetics	136,296
Sub-total (Wide)	3,392,316
Total Domestic	8,243,926
Export Shipments	179,594
TOTAL SHIPMENTS	8,423,520

* This figure includes Fruit Jars, Jelly Glasses and Packers' Tumblers.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All Figures in Gross)

		Production February 1954	February Stocks 1954
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	3,324,389	4,008,832
	Wide Mouth	*3,578,548	*3,983,312
Dairy Products		168,528	312,254
Beverages, Returnable		561,580	1,268,176
Beverages, Non-returnable		66,182	170,497
Beer, Returnable		238,110	407,416
Beer, Non-returnable		644,592	934,678
Liquors		652,361	1,021,287
Wines		322,300	456,615
TOTAL		9,556,590	12,563,067

* This figure includes Fruit Jars, Jelly Glasses and Packers' Tumblers.

Glass container production, based on figures released by the Bureau of Census, fell off during February 1954 to reach 9,556,590 gross. Compared with January's 10,009,026 gross, a drop of 4.5 per cent is indicated. During February 1953, production of glass containers was 9,000,228 gross, or 6.8 per cent below February this year. At the end of the first two months of 1954, glass container manufacturers have produced a total of 19,565,616 gross. Compared with the 18,292,878 gross produced during the first two months of 1953, a rise of 6.9 per cent is indicated for this year.

Shipments of glass containers during February 1954 also dropped and were reported to be 8,423,520 gross. This is 6.3 per cent below the previous month's shipments of 8,996,675 gross. During February 1953, shipments were 8,670,985 gross, which is 2.8 per cent above February this year. At the end of the first two months of 1954, a total of 17,420,195 gross of glass containers have been shipped. This is .4 per cent behind the 17,507,519 gross shipped during the corresponding period last year.

Stocks on hand at the end of February 1954 were 12,563,067 gross. This is 9 per cent higher than the 11,519,751 gross on hand at the end of January 1954 and 17.6 per cent higher than the 10,677,214 gross on hand at the end of February 1953.

Automatic tumbler production during January 1954 was 5,180,462 dozens. This is a 25.6 per cent jump over the 4,123,862 dozens produced during December 1953. Production during January 1953 was 5,975,243 dozens. Shipments also increased and were reported to be 4,399,343 dozens. Compared with December 1953 shipments of 3,913,846 dozens, a rise of 12.4 per cent is shown. Shipments during January 1953 were 5,399,067 dozens. Stocks on hand at the end of January 1954 rose 1.6 per cent to reach 10,356,210 dozens. This is an increase over the previous month's 10,184,245 dozens. Stocks at the end of January 1953 were 8,723,606 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware rose 12.5 per cent during January 1954 to reach 2,750,140 dozens. This is an increase over December 1953 sales of 2,443,630 dozens. Sales during January 1953 were 3,652,091 dozens. At the end of the 12-month

(*Continued on page* 224)

Unretouched photo looking toward dog house end.
Note uniform wear throughout.

Walsh Vacuum Cast Bottom Blocks Establish Unique Performance Record For Obear-Nester Glass Co.

With a maximum service life of 32 months for all other materials in this tank, the 12" thick bottom constructed of Walsh Vacuum Cast Blocks alone withstood the acid test of time . . . revealed but a 1" loss in thickness representing only 8½% wear. Naturally, at this rate, the bottom is still good for years of economical, trouble-free service.

Yes, here's a lesson in economy—not only when you look at low first cost and astounding long life but also the marked resistance to contamination in the shift from the production of flint to amber glass. All the significant, money-saving facts are contained in the operating data in the table (at right).

We think these figures clearly demonstrate that it just isn't economically sound to use anything other than Walsh clay blocks in bottoms. In fact, isn't this kind of proven performance just what you have been looking for. We'll be glad to furnish additional details. Let's talk it over . . . soon.

Also makers of well known and favorably regarded premium quality Mulliflux Vacuum Cast Sidewall and Bottom Blocks and Cast Sillimanite Refractory for Upper Structure.

Look At The Record
. . . as reported by
Obear-Nester Glass Co.

GLASS	Flint & Amber	
SIZE	Square Feet of Melting Area	570
	Sidewall Height in Inches	42
LIFE	Total Operating Days (Melting Flint)	100
	Total Operating Days (Melting Amber)	826
	Total Idle Days	23
	Total Days Under Fire	949
PULL	Tons Glass Melted (Flint)	8,473.74
	Tons Glass Melted (Amber)	85,638.95
	Total Tons Glass Melted	94,072.69
	Tons Glass Per Operating Day	101.59
	Tons Glass Per Square Foot—Melting Area Per Life	165.04
	Square Feet Melting Area Per Ton Glass Per Operating Day	5.61
FUEL	Natural Gas	
	Ton=2000 Lbs.	

WALSH REFRACTORIES CORPORATION — America's Best Clays

WALSH REFRACTORIES CORPORATION

101 FERRY STREET • ST. LOUIS 7, MISSOURI

FOR OVER 50 YEARS MANUFACTURERS OF HIGH GRADE REFRACTORIES

JAMES A. ARRANDALE RETIRES FROM THATCHER

The Thatcher Glass Manufacturing Company, Inc., has announced the retirement of James A. Arrandale, Director of Quality Control. The Glass Container Manufacturers Institute has marked the occasion by honoring Mr. Arrandale in a special resolution commending his contributions to that organization and to the glass industry as a whole.

Mr. Arrandale's 42 years of service with Thatcher have been liberally marked by new developments and improvements in glass container manufacturing equipment and processes. In addition, his helpfulness, integrity and ready humor have won for him the admiration and respect of everyone throughout the glass industry.

Born in Oglesby, Illinois, in February, 1888, he was foreman in a metal stamping plant at 19. Shortly thereafter he invented a mechanical pencil which multiplied and divided, but he went broke on the project. This led to the beginning of his career with Thatcher in the summer of 1912. He came to their Streator, Illinois, plant as a toolmaker at a time when the glass industry was starting to make interchangeable parts of bottle mold equipment on a mass production basis.

Mr. Arrandale's technical contributions to the company were numerous. He built one of the first "carrying-in-machines," as they were called at that time, and made numerous mechanical improvements. He built the first testing laboratory Thatcher ever had. He was the first to put cooling fins on blank molds. He worked with Professor Frink of England in building at Streator a full-scale furnace in which the glass was melted on an inclined plane. He was one of the first to have an optical pyrometer, and one of the greatest advocates of its use. In 1927, he was made Assistant Plant Superintendent in charge of production, including furnace operation.

Thatcher was one of the first to decorate bottles with colored lettering, and from its inception, he played a great part in the development of the art with numerous devices —star wheels, stackers, hand machines, power machines, drying tunnels and even a single-line glazing lehr which glazed a bottle in a couple of minutes, but in which he found no practical way of cooling the bottle down without excessive breakage.

During this time, he authored several papers on glass and glass furnaces which appeared in technical magazines. He undertook technical service to the customers as well, gave lectures, took customers' laboratory personnel into the plant for training in how to know and test bottles.

In 1935, Mr. Arrandale transferred to Thatcher's general offices in Elmira, New York, as a Research and Development Engineer. A year later, he was made General Production Manager of all Thatcher plants. From 1943 to 1947, he was Assistant to the Vice President in charge of Plant Operations. He spent the winter of 1947-48 in South America, lending valuable technical assistance to two glass manufacturing companies in Brazil and Uruguay.

In 1948, following the trend of the times, he became organizer and director of a newly-formed department of Quality Control and Customer Service, the position he held until his retirement. In this, his complete background of knowledge concerning glass, the working of glass and its use by the customer resulted in the new development of very high levels of quality.

Mr. Arrandale has been a member of several committees of the Glass Container Manufacturers Institute and the old Glass Container Association before that. He has made substantial contributions to the standardization of glass containers in the United States.

APPOINTMENTS BY PACIFIC COAST BORAX

Maurice H. Pickard has been appointed Director of Technical Service and Product Development, and Roger W. Hinchman has been appointed Eastern Sales Manager, Industrial Division, according to an announcement by J. F. Corkill, Vice President of Pacific Coast Borax Company, Division of Borax Consolidated, Limited.

Mr. Pickard received his technical training at Tufts

M. H. Pickard

R. W. Hinchman

College where he graduated in 1923. After several years with American Smelting & Refining Company in Mexico, he joined the Pacific Coast Borax Company as Chief Chemist at their plant at Boron, California, in 1936. After several years as Assistant Mill Superintendent at Boron, and Refinery Superintendent at Wilmington, California, he was transferred to the New York sales office in 1944. Mr. Pickard will continue to be in charge of technical service and he is also organizing a new department which will be responsible for the development of various new boron products.

Mr. Hinchman, a graduate of the University of California and the University of Southern California, began his career with DuPont where he remained for nine years. Since joining Pacific Coast Borax in 1943, he has worked in various sales capacities and prior to coming to New York, had been in charge of industrial and agricultural sales in San Francisco. In his new position, Mr. Hinchman will have charge of the company's industrial sales in the area east of the Rockies.

• Richard M. Fulrath has been appointed an Associate in Ceramic Engineering on the Berkeley campus of the University of California. He joined Professor Joseph A. Pask in the Ceramic Laboratories of the Division of Mineral Technology.

HARSHAW FLUORIDES WORK

like magic

BORON TRIFLUORIDE

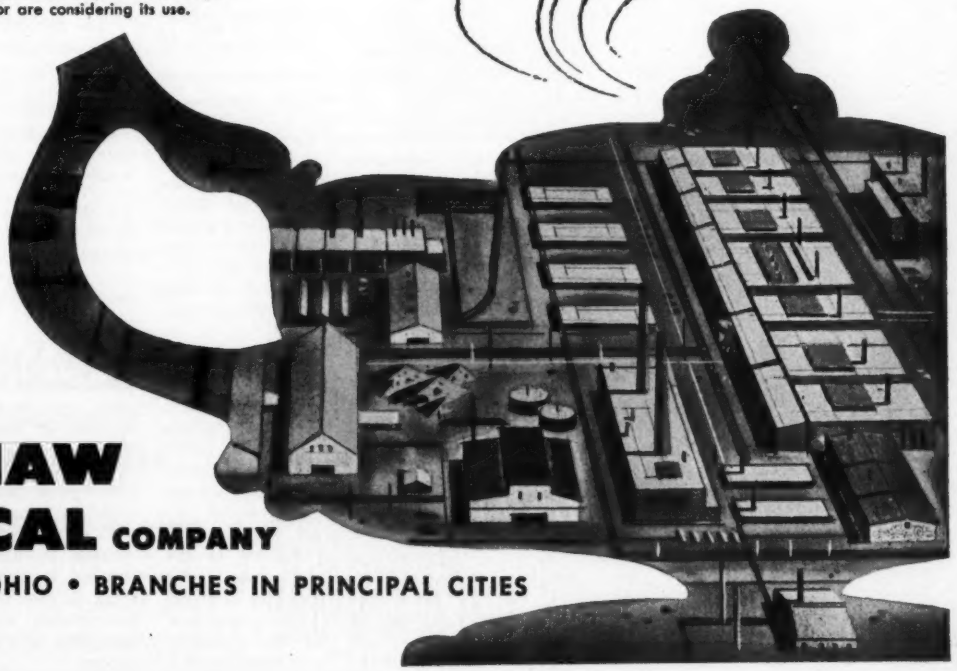
HYDROFLUORIC ACID

• ANHYDROUS • AQUEOUS

Here is an additional group of production-controlled, high-quality fluorides:

- Ammonium Bifluoride
- Ammonium Fluoborate
- Antimony Trifluoride Sublimed
- Barium Fluoride
- Bismuth Fluoride
- Boron Trifluoride
- Boron Trifluoride Complexes
- Chromium Fluoride
- Copper Fluoborate
- Fluorboric Acid
- Fluorine Cells
- Fluorinating Agents
- Frosting Mixtures
- Hydrofluoric Acid Anhydrous
- Hydrofluoric Acid Aqueous
- Hydrofluosilicic Acid
- Lead Fluoborate
- Metallic Fluoborates
- Potassium Bifluoride
- Potassium Chromium Fluoride
- Potassium Fluoborate
- Potassium Fluoride
- Potassium Titanium Fluoride
- Silico Fluorides
- Sodium Fluoborate
- Tin Fluoborate
- Zinc Fluoborate
- Zinc Fluoride

Write for Harshaw's 40-page Book on Hydrofluoric Acid Anhydrous. It provides helpful data for you if you now use HF or are considering its use.

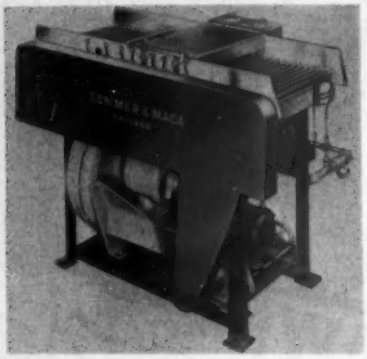


THE

HARSHAW CHEMICAL COMPANY

CLEVELAND 6, OHIO • BRANCHES IN PRINCIPAL CITIES

New Equipment and Supplies



GLASS WASHING MACHINES

Sommer & Maca Glass Machinery Company, 3600 S. Oakley Avenue, Chicago 9, Illinois, has developed two new models of automatic glass washing and drying machines designed for washing and drying both sides simultaneously of small circles, ovals, squares, rectangles and odd shapes of glass and mirrors.

Both the new 12″ and 20″ models are built with many of the construction features popular in the larger Sommer & Maca 40″, 60″ and 80″ models, and are said to produce top quality results with a long life of service.

GLASS CUTTING TOOL

Hatfield Products, 555 Chester Pike, Sharon Hill, Pa., has announced a new type of glass cutting tool, called Sure-Cutter, which consists of a spring tension arm and tempered steel cutting wheel, with the unit set into a colorful red styrene hand grip.

The Surc-Cutter hand grip has a flat bottom which is supported on an angle by the spring tension cutting arm. When the cutter is put to use, this bottom edge is brought against the glass surface. By enabling its user to exercise the full gripping power of his hand, the glass cutter offers accurate leverage for cutting straight lines, circles, ovals on plate glass, window glass, safety glass, mirrors and others up to ¼ inch thick.

NEW SERIES OF B&L POLARIZING MICROSCOPES

Bausch & Lomb Optical Company, 635 St. Paul Street, Rochester 2, New York, has announced a new series of polarizing microscopes for use in the glass industry and related fields.

The new instruments feature a ball-bearing, low-position, fine-focusing stand previously available only with the company's line of Dynoptic laboratory instruments. Contributing further to the ease of operation and accuracy of determinations, is a ball-bearing, revolving stage with one-degree graduations and venier reading to six minutes of arc. A ball-bearing double nosepiece with ball stop and true return to centration when changing objectives is employed. Standard equipment is 10X and 45X strain-free achromatic objectives.

ALUMINUM PALLET

The Louisville Metal Products Company, 1101 W. Oak Street, Louisville 10, Kentucky, has developed an aluminum pallet which the company believes would be of interest to glass manufacturers because of its lightness, allowing them to increase the height of their stacking without crushing the product.

Aluminum pallets have advantages in that they will not burn, rust, rot or warp and add materially to the safety factor since they are non-sparking and their lightness relieves the tendency of back strains, hernia, etc., when handling and unloading pallets.

NEW "AIRBRASIVE" UNIT

S. S. White Industrial Division, 10 East 40th Street, New York 16, New York, has introduced a new Model C "Airbrasive" unit which can be used for precision cutting, drilling, etching and light deburring on hard brittle materials.

The cutting action is performed by a fine stream of gas-propelled abrasive particles, traveling at near supersonic speeds, directed at the work through a small orifice nozzle. A selection of right-angle and straight nozzles with round and rectangular orifices is available for different cutting requirements. With the smallest nozzle, lines as fine as .008″ can be cut.

The "Airbrasive" cutting action is accomplished without the usual increase in temperature ordinarily experienced with other cutting methods. Another advantage claimed for the "Airbrasive" process is that surface irregularities in the material being worked do not affect the accuracy of the cut. The unit is electrically controlled, operating on 110 volt, 60 cycle A.C. current. Any dry, inert cylinder gas can be used as the propellant gas.

UNIVERSAL GRINDING MACHINE

Norton Company, Worcester, Mass., has announced a new universal grinding machine, the 12″ Type U-4, which has been designed to provide extra versatility through simplified set-ups and fast, precise grinding action for limited production items.

The principle new feature is the swiveling headstock which has a dog drive plate on one end for conventional grinding and a 5″ D-1 cam lock nose on the other end for mounting chucks or fixtures. To change from a dog-drive set-up to a chucking operation, it is only necessary to rotate the headstock 180 degrees and set up the work. When work is being ground on dead centers, the chuck does not rotate because the headstock is a combination live and dead center type.

A work speed range of 40 to 400 r.p.m. in an infinite number of increments is available at the turn of a dial. No direct current source is required as the headstock drive is A.C. controlled through rectifiers.

SEALING COMPOUND

Presstite Engineering Company, 3798 Chouteau Avenue, St. Louis 10, Missouri, has announced Presstite Permagum sealing compound, a mastic compound furnished in extruded ribbon form suitable for glazing or sealing double glass windows.

Permagum is said to offer a positive and permanently airtight and watertight seal. The material never hardens, never dries, never shrinks, never slumps. Its flexibility permits expansion and contraction of the glass and frame without breaking the bond. The sealer can be applied immediately as received, requiring no warming, and is quick, easy and clean to work with.

CATALOGS RECEIVED

The Cambridge Wire Cloth Company, Cambridge, Maryland, has issued a four-page folder featuring "Automation", the application of automatic operations to continuous production processes.

The folder, which points up the place of Cambridge's woven wire conveyor belts in this application, illustrates the use of the company's belts in the glass and ceramics industries, chemical industries, metalworking and in food processing. The folder also briefly describes the particular application.

The Foxboro Company, Foxboro, Mass., is distributing a new 8-page Bulletin A-303 describing two portable temperature indicators, the Potentiometer Indicator and the Resistance Thermometer.

Described in detail are operating adjustments, features of design, test circuits, measuring elements and instrument specifications. An entire page is devoted to listing the standard scales available, covering temperatures from —200 F. to 2800 F. Tables also list the type of thermocouple or resistance bulb recommended for each range, as well as the degrees of temperature indicated by each scale division. Also covered is the use of portable pyrometers in checking installed pyrometric instruments and in replacing potentiometers which are temporarily out of service.

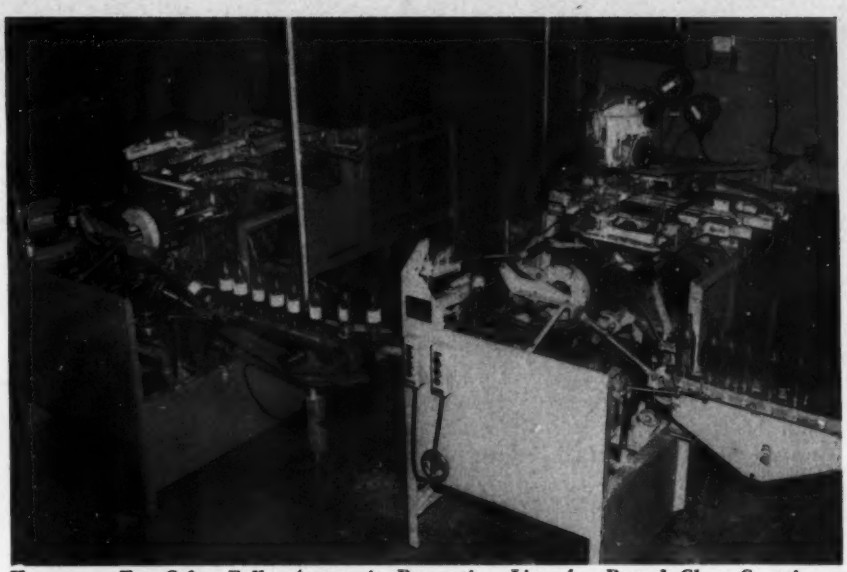
THE HAGERMAN AUTOMATIC CONTAINER DECORATOR

MODEL 65G25

•

A Fully Automatic Decorating Line For Round Glass Containers

•



Hagerman Two-Color Fully Automatic Decorating Line for Round Glass Containers. (Unscrambler equipment not shown.)

Model 65G25 is designed to decorate round glass containers in sizes ranging from about 6 ounces to the full 32-ounce (quart) beverage bottle, with accurate register of successive colors in multi-colored decorating by the screen process. Fully automatic color registration is provided as shown in the accompanying photographs.

This equipment can be obtained either as a complete decorating line or as an attachment to your present Solar M S A Type Decorating Machines. Production of 600 gross, net pack, is possible in a 24-hour period. Offware should not exceed 1½%.

Photographs show equipment in operation in the Decorating Department of a large glass plant in southeastern United States, which has purchased six units. New 1954 models have been redesigned for better production based on experience with some 26 units now installed and in operation in several glass plants.

The First Color Decorating Operation and Equipment, utilizing the new "Hot Color Process."

Increased production facilities now permit us to offer early deliveries.

WRITE FOR FULL INFORMATION.

LAWRENCE HAGERMAN

Industrial Engineer

9048 EAST TELEGRAPH ROAD
RIVERA, CALIFORNIA

***Telephones:* Topaz 2-2335 and Oxford 3-3359**

Write us concerning your equipment requirements for the A.C.L. process. We have improved screen heating units for thermoplastic colors. Other types of equipment are under development.

A Close-up, Showing Details of the Register Mechanism.

ANTI-LITTER CAMPAIGN TAKING FORM

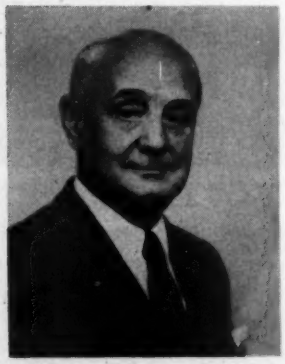
The Department of Commerce has issued an announcement concerning the long-rumored anti-litter campaign. Representatives of many sponsoring trade organizations who were present at the recent Consumer Package Industry Conference said that a non-profit corporation, to be known as Keep America Beautiful, Inc., was in the process of organization. Its function will be to "combat the growing volume of litter along America's highways, parks and beaches."

The glass packaging industry has a keen interest in this new undertaking, particularly in the single-trip segment of the beverage and beer trades. Through KAB, such arbitrary legislation as Vermont's ban on one-way beer bottles may be obviated. With this in mind, the glass container industry has been one of the original promoters of KAB.

The Commerce Department's announcement added that Keep American Beautiful, Inc. would sponsor public education aimed at eliminating roadside litter and would enlist such outdoor organizations as the Boy Scouts, garden clubs, the Izaak Walton League and the National Parks Association.

Glass is represented in the KAB organization by the naming of Harry Kuni of the Glass Container Manufacturers Institute as Treasurer, and Joseph McGarry, Owens-Illinois Glass Company, will also serve on the initial management committee. At present the project is being steered by a committee composed of H. N. Calver, Paper Cup and Container Institute; R. E. Dalton, U. S. Brewers Foundation; E. K. Walsh, American Can Company; Mr. McGarry and Mr. Kuni. John C. Rose is Executive Director with offices at 100 Park Avenue, New York City.

HARBISON-WALKER APPOINTMENT



William F. Rochow has been named Assistant to the President - Research and Development, it has been announced by Earl A. Garber, President of Harbison-Walker Refractories Company. Mr. Rochow has relinquished his title of Vice President in charge of Technical Sales and Research because of the company's retirement policy.

Mr. Rochow graduated from Penn State in 1912 and has been connected with Harbison-Walker ever since. His first assignment was to Hays Research Laboratory at Hays, Pa. In 1915, he was brought into the main offices in Pittsburgh where he served as sales correspondent for a time and later had charge of the sale of special clays and other new products. In 1919, he was given a Western sales territory consisting of the Pacific Coast and adjoining states. After a few years, he turned his attention to service problems on refractories and his work in this connection marked the beginning of the company's Technical Sales Department.

Mr. Rochow has served Harbison-Walker as Assistant General Sales Manager, Assistant to the President and, more recently, as Vice President in charge of Technical Sales and Research.

LACLEDE-CHRISTY APPOINTMENTS

Laclede-Christy Company has announced the appointment of J. W. Rogers to the newly-created post of Special Glass Refractory Consultant. Mr. Rogers will be able to devote his specialized knowledge and technical skill of many years of glass furnace refractory experience to both domestic and foreign users of glass melting furnace refractories.

Mr. Rogers, formerly Manager of Glass Industry Refractory Sales, has been with Laclede-Christy since 1925 in sales and supervisory capacities. He received an A.B. from Washington and Jefferson College in 1916, a B.S. in Mechanical Engineering from Massachusetts Institute of Technology in 1920, and an S.B. Mechanical Arts from Harvard in 1920.

J. W. Rogers

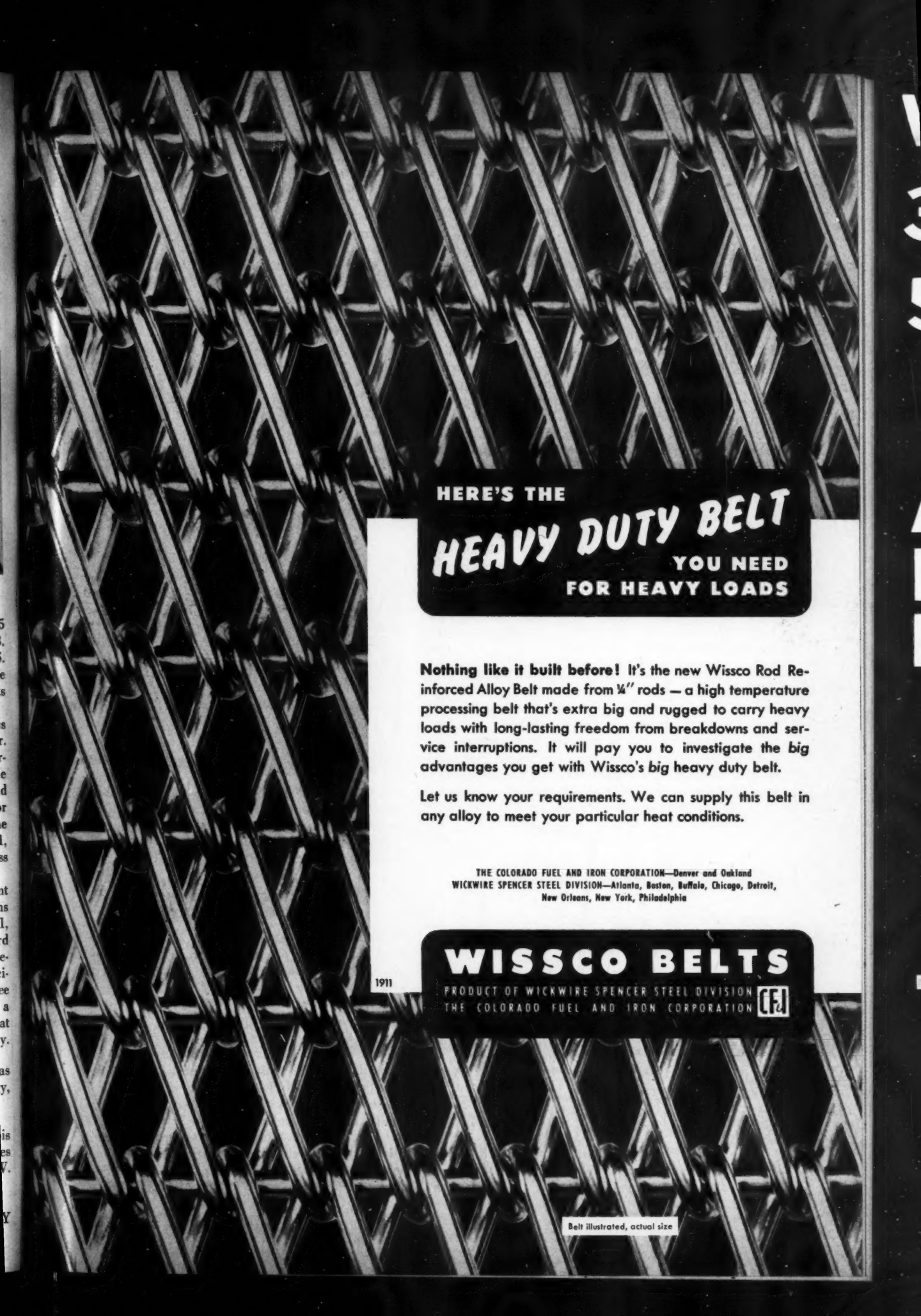
R. N. Helmkampf

Named to succeed Mr. Rogers as Manager of Glass Industry Refractory Sales is R. N. Helmkampf. Mr. Helmkampf has a B.S. Degree in Mechanical Engineering from Washington University in St. Louis. He joined Laclede's Engineering Department in 1935, and was a Sales Engineer from 1942 until 1950, except for service in the U.S. Navy during World War II where he attained the rank of Lieutenant. From 1950 to March 1, Mr. Helmkampf has been Assistant Manager of Glass Industry Sales.

Also announced by the company is the appointment of Russell C. Stone as Director of Industrial Relations and Personnel. Mr. Stone joined Laclede on March 1, 1954, having recently been with the Alton Box Board Company as Manager of their Industrial Relations Department. He is a member of the Missouri Bar Association and the Industrial Relations Executive Committee of Associated Industries, and for the latter he was a Director of Research from 1942 to 1944. Prior to that time he was Assistant Attorney General in Jefferson City.

• J. Earl Frazier, President of Frazier-Simplex, Inc., has been made a Fellow of the Society of Glass Technology, England.

• Preston Levis, Chairman of the Board of Owens-Illinois Glass Company, has been elected to the Board of Trustees of Cornell University, succeeding the late Thomas W. Pew, of Houston, Texas.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YOU NEED
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Nothing like it built before! It's the new Wissco Rod Reinforced Alloy Belt made from ¼" rods — a high temperature processing belt that's extra big and rugged to carry heavy loads with long-lasting freedom from breakdowns and service interruptions. It will pay you to investigate the big advantages you get with Wissco's big heavy duty belt.
Let us know your requirements. We can supply this belt in any alloy to meet your particular heat conditions.
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WICKWIRE SPENCER STEEL DIVISION—Atlanta, Boston, Buffalo, Chicago, Detroit, New Orleans, New York, Philadelphia
1911
WISSCO BELTS
PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION
CF&I
Belt illustrated, actual size

INVENTIONS AND INVENTORS . . .

(*Continued from page* 200)

heating the tank and other electrodes are used for overheating.

The patent contains two claims and 28 references were given.

Support for Tubular Glassware in Burning-Off Operations. Fig. 9. Patent No. 2,660,833. Filed January 2, 1952. Issued December 1, 1953. Two sheets of drawings. Assigned to West Virginia Glass Specialty Company by John C. Weber, Jr.

The invention is concerned with an improved device for supporting glassware in burning-off operations. In Fig. 9, the glass pitcher P is so supported that its axis a′ intersects the axis a of the plate 10 at the point i which is in the cutting-off or burning off plane cp.

If it were desired to burn off the pitcher P in a plane parallel with and below the plane cp, it would be necessary to adjust the member 18 toward the axis a. Furthermore, if a different angle to the top edge of the pitcher is desired, it will be necessary to adjust the angularity of the member 18 relative to the plate 10 and such will also require a diametrical adjustment. The purpose of having the axes of the plate and glassware, or member 18, intersect in the burning-off plane is to avoid an otherwise wobbling action of the glassware upon rotation of the plate 10.

The patent contains five claims and the references cited were as follows: 1,414,970, Nelson, May 2, 1922; 1,450,807, Hines, Apr. 3, 1923; and 1,482,272, Smith, Jan. 29, 1924.

Frosted Incandescent Lamps. Patent No. 2,661,438. Filed July 20, 1949. Issued December 1, 1953. One sheet of drawings (none reproduced). Assigned to Monsanto Chemical Company by Lloyd D. Shand.

This invention relates to methods for imparting light-diffusing properties to lamp glass envelopes. The potentially light-diffusing compositions comprise as essential ingredients a mixture of a major proportion of an alkaline-reacting aqueous solution of colloidal silica (otherwise known as an alkaline-reacting silica aquasol) and a minor proportion of a substantially white, finely divided, solid silica such as a silica aerogel or silica xerogel.

Compositions which are particularly useful, and are preferred for coating incandescent lamp envelopes, are those comprising a mixture consisting of from 3 to 7% by weight of the finely divided, solid silica and from 97 to 93% by weight of an alkaline-reacting silica aquasol containing from about 19 to 35% by weight of colloidal silica.

Good results have been obtained by applying the above-described compositions to a clear glass surface, or a chemically etched glass surface, or to a mechanically roughened glass surface. In general, glass surfaces may be heated to temperatures as low as 100°C. to obtain satisfactory results on spraying while the spraying of glass surfaces which have been previously heated to temperatures of 350 to 400°C. often gives superior results.

The patent contains 12 claims and 12 references were cited.

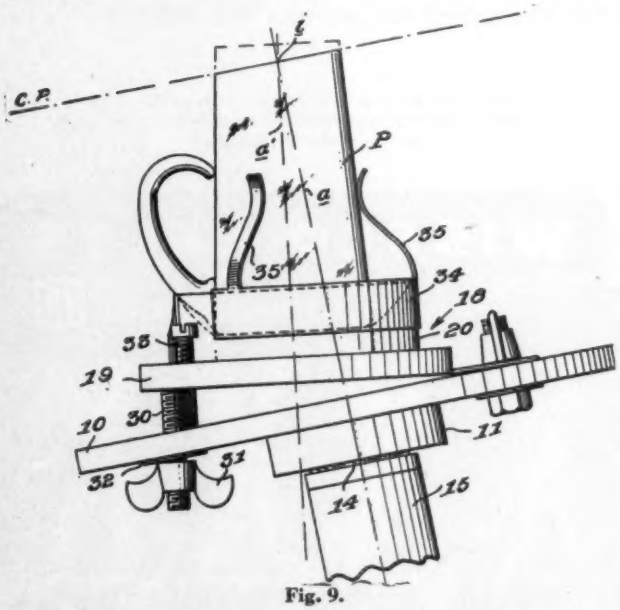

Fig. 9.

JOSEPH BOYCE NAMED VITRO GENERAL MANAGER

Joseph Boyce has been named General Manager of Vitro Manufacturing Company, a division of Vitro Corporation of America, according to J. Carlton Ward, Jr., President.

Mr. Boyce has been with Vitro since 1947, serving successively as Laboratory Director, Sales Manager and Plant Manager. Previously he was with Ceramic Color & Chemical Company, Ferro Corporation, Bell Aircraft of Buffalo and E. I. du Pont de Nemours & Co., Inc. in Columbus, Ohio.

Mr. Boyce attended Geneva College and the Carnegie Institute of Technology.

V. C. SWICKER ESTABLISHES CONSULTING SERVICE

Victor C. Swicker, formerly Glass Technologist and Technical Adviser for Alexander H. Kerr & Company, Inc., has set up an independent consultation service to deal with glassmaking problems, special investigations and production control. Mr. Swicker also offers service relating to glass sand technology and training of technical personnel.

Mr. Swicker's original technical experience was in the sugar industry. Working in this field for three years, he later joined the National Bureau of Standards in the Sugar Section for three years, then transferred to the Optical Glass Section for two years. He has had 20 years service with the Hartford-Empire Company where he was chief chemist for about seven years and glass technologist during the remaining years. Mr. Swicker's headquarters are at 907 Floral Drive, Whittier, California.

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CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS

STEMS WITHOUT STRAINS . . .
(*Continued from page* 192)

annealing equipment is a tool hardening furnace and quench tank. In the illustration, a workman is shown quenching a tool that has just been taken from the furnace. Also shown is the ElectroniK circular scale controller that holds the furnace at the temperature required for proper hardening. Type K thermocouples are used on this 0-2000 F. rotating scale instrument.

All the modern techniques and equipment employed are quite different from those used in the original plant which started operations 50 years ago at Emporium. Then the only product was incandescent lamps. Now, as Sylvania celebrates its golden anniversary, its assembly plants, sales offices and research centers are spread across the country. The list of products now includes a wide variety of electrical and electronic goods—radios, television sets, fluorescent lamps and fixtures, incandescent lamps of all sizes, picture tubes, radio tubes, photoflash lamps, and numerous industrial items. Quick adoption of advanced technology and instrumentation have helped Sylvania become a leader in its field.

A.C.S. GLASS SESSIONS . . .
(*Continued from page* 185)

ductivity," W. D. Kingery, Massachusetts Institute of Technology; "Preparation and Properties of Calcium Zirconate," M. R. Nadler and E. S. Fitzsimmons, Iowa State College; "Effect of Temperature and Impurities on the Sintering of Alumina," H. P. Cahoon, Interstate Brick Co. and C. J. Christensen, University of Utah; "Method for Determining Shot in Refractory Fibers," E. C. Hoeman, Babcock & Wilcox Co.

Following the customary pattern of annual meetings, in addition to the technical sessions of the various divisions, there will be general meetings of the Society. The National Institute of Ceramic Engineers will hold its annual meeting as a part of the Society's program and there will be a meeting of the Ceramic Educational Council made up of the men who conduct the ceramic schools.

Ceramic engineering students will hold a speaking contest, attend technical sessions and serve as pages. A student employment service will bring together senior students and prospective employers.

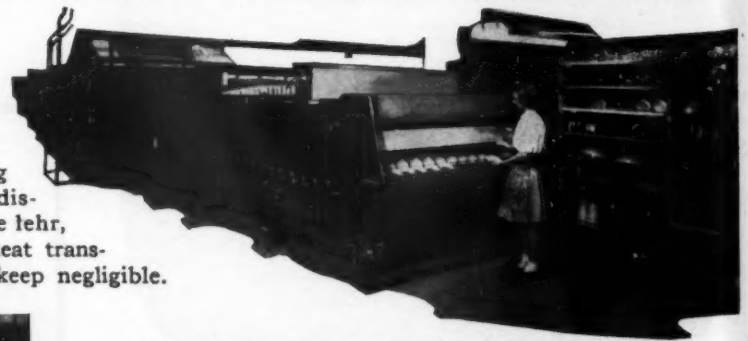
The 22nd Edward Orton, Jr. Fellow Lecture will be delivered by Dr. Edward H. Kraus of the University of Michigan at the general session Tuesday morning. His subject will be "Gems—Natural and Synthetic."

Announcement of the Honorary member, the highest recognition for achievement in the ceramic field, will be made at the banquet Wednesday night. The Society's constitution provides that only ten living persons may hold this distinction. Other honors to be presented at the banquet will be the Ross Coffin Purdy Award for the most valuable contribution to ceramic technical literature during 1953, the Charles Fergus Binns Medal for the artist creating the best piece of ceramic art during the past year and elevation of 13 members to Fellows of the American Ceramic Society. The annual banquet, an evening floor show and dancing, and tours of some of the ceramic plants in the Chicago area are scheduled.

TECO Decorating Lehrs

to handle LIGHT and HEAVY DECORATED GLASSWARE

Economical to Operate and Maintain . . . For the efficient application of gold and colors to light and heavy glassware. Uniformity of heat distribution by proper burner design and placement of alloy, high heat resisting muffletubes. Uniform temperature distribution across entire width of the lehr, above and below glassware. Rapid heat transfer with fuel economy. Firebox upkeep negligible.



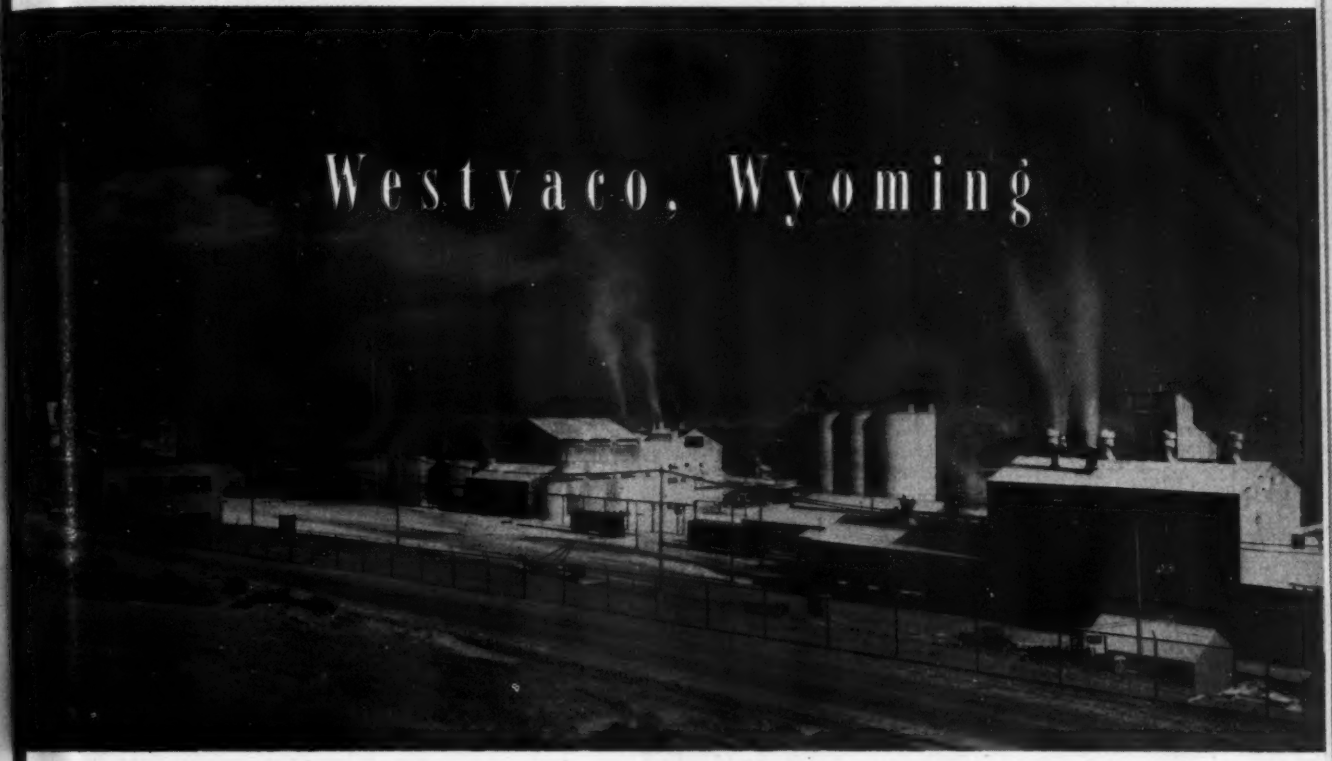
WRITE FOR PARTICULARS

TOLEDO ENGINEERING Company

GLASS MELTING and MANUFACTURING EQUIPMENT

• 3001 SYLVANIA AVENUE, TOLEDO 13, OHIO

New Process... New Plant
NEW SOURCE OF SODA ASH



Refined by an exclusive process from the greatest deposit of pure trona yet to be developed, WESTVACO Soda Ash equals or exceeds every accepted standard of soda ash quality. Chemically, it is low in iron, chlorides and sulfates. Physically, Westvaco Light Ash has a crystalline structure which imparts excellent dispersal properties and a rapid rate of solution. Its free-flowing crystals handle easily in processing operations.

Three grades are available: *Regular Dense Ash* with a bulk density of approximately 63 lb./cu. ft. and a screen analysis which has proven to be very acceptable throughout the glass industry. *Granular Dense Ash*—a singularly dust-free product with granular characteristics which improve the handling qualities. *Light Ash*—a bulk density of approximately 48 lb./cu. ft. which increases storage capacity.

Soda ash users from the Mississippi Valley to the Pacific can benefit *right now* by this economic new source of high quality ash. We will be pleased to furnish specifications, samples and prices to prospective users within or nearby our current shipping area.

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(*Continued from page* 191)

Fig. 13. The second impact at 9.4 mph. registered in the fourth quarter of Zone 4 caused considerable damage to boxes and developed 3 to 5″ slack in other end of car due in part to crushing of boxes as shown in Fig. 12. Before shipping car to customer, 30 boxes were repaired and 16 were replaced. One lite of glass was broken. It had a small corner off.

Fig. 14. Following the impacts in April 1953, we changed the method of blocking to eliminate the deficiencies discovered in the cars of the type represented by Car No. 2 in that series of tests. These new methods were followed up and checked in actual practice during the year until December 1, 1953, at which time we loaded PRR Car 85646 with standard 50′ boxes of flat drawn sheet glass with the door opening blocked and, in cooperation with the Frisco Railroad, conducted a series of impact tests on this car.

Fig. 15. Some slack was evident in the end of the car on each impact. Impact No. 4 broke the lid on one box and there was some crushing of boxes, such as the sheared lid shown above, when the recorder indicated 11 mph. impact. Both we and the railroad people, who observed this test, are confident that this type of blocking and bracing is adequate for this type load for all normal handling to any destination.

of chat into the loaded car of glass. When the heavy load of chat hit the car, the impact registered much higher than when the lighter car of glass hit the chat at the same mph. speed.

Following these impact tests, we have been more inclined toward segmental loading. The principles of this type load are exemplified in the "D. F. Loader", which is a R. R. car equipped with angles along the walls punched about 1½″ apart to receive keepers attached to cross bars. A segment of the load can be placed in the car, a wooden gate or frame set against the load and the cross bars placed to hold that part of the load independent of the next portion. We have found that bracing segments of the load with steel straps or blocking promotes safe arrival.

A few observations following these tests are: (1) The use of our impact recorder helps promote the good will of the customer. (2) Its use enables us to assist the carrier in promoting safe arrivals. (3) Costs of blocking and bracing are pinpointed and weighed. (4) Zoning of damages by sections or destinations permits special precautions with shipments going to certain areas of the country. (5) Having plant personnel help conduct tests and research informs, inspires and increases their efficiency. (6) The relationship of one unit or package to the other regarding transfer of load or pressure through the unit or package at the strongest point is important in preventing crushing and other forms of damage. (7) Multiple layers in the load are oftentimes responsible for damage when each successive layer is not properly blocked or anchored. (8) One heavy impact does more apparent damage to blocking and bracing than several 3 or 4 mph. impacts. (9) We have determined the impact against which we think we must fortify our load. This is subject to change with further research and experience. (10) Data on loading, blocking and bracing window glass seems to be very scarce.

These tests are only the first of several that we plan to conduct in an effort to get our product in the hands of our customer safely. As a matter of fact, we concluded

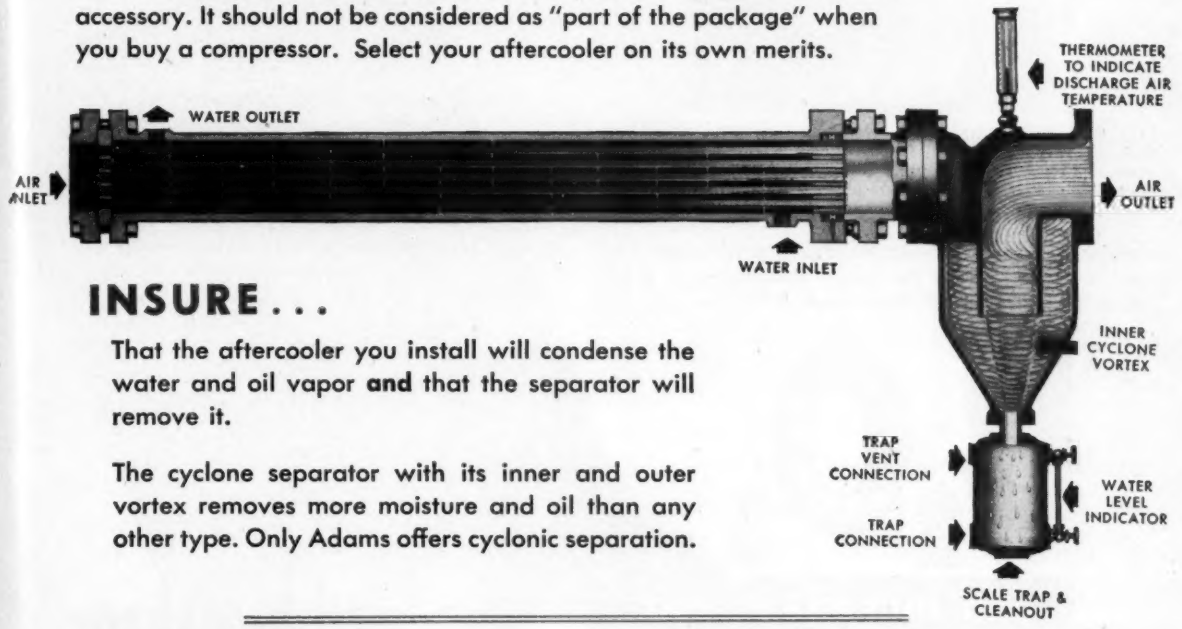
(*Continued on page* 218)

LOSING MONEY ON WET, DIRTY AIR?

Rx ...SEE A SPECIALIST!

Removal of moisture from compressed air is a problem entirely independent from the type of compressor used. It is a problem for **specialists** in the design and manufacture of aftercoolers. Specialists for nearly two decades, the R. P. Adams Co. has built a solid reputation on the aftercooler and cyclone separator that are chosen throughout industry for better performance, price and delivery.

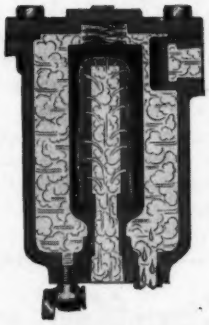
The aftercooler you install to protect air operated equipment is not an accessory. It should not be considered as "part of the package" when you buy a compressor. Select your aftercooler on its own merits.



INSURE...

That the aftercooler you install will condense the water and oil vapor **and** that the separator will remove it.

The cyclone separator with its inner and outer vortex removes more moisture and oil than any other type. Only Adams offers cyclonic separation.



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Why Adams Poro-Stone Air Filters are Famous

1. Rapid diffusion and filtration through permanent, cleanable Poro-Stone.
2. Centrifugal separation of dirt and liquids.
3. Drainage to trap directed by cast-in slots.
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6. Less than ½ lb. pressure loss at rated capacity.

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R. P. ADAMS CO., INC. 218 EAST PARK DRIVE BUFFALO 17, N. Y.

SAFE LOAD IMPACTS . . .

(*Continued from page* 216)

Fig. 16. Very little additional damage was noted up through Impact No. 11 after having subjected the load to normal heavy railroad yard handling. However, on Impact 12, with the recorder reading 11 mph. impact, the floor blocking on one end moved some, as shown above.

a series of impact tests in the Frisco yards about two hours before I boarded the train to this meeting as a follow-up to improvements that we made in blocking and bracing procedures following the failures in Car No. 2 during the tests in April. The improved type blocking and bracing withstood the testing impacts satisfactorily and we are confident that this type load can be properly blocked and braced for all normal handling to any destination.

A statement made recently by a R. R. man indicated that the damage claims for glass products averaged about $2.00 per car. We may well say that for $2.00 per car we cannot afford much additional labor or blocking material. However, at the same time we cannot afford to lose or even inconvenience a good customer. Therefore, we must do all things necessary to insure our products against damage all the way.

What are "Safe Load Impacts?" We have evolved the bright idea that they are the ones that our product and load will take without damage. And by these simple tests and this type practical research, our damages as a result of impacts have been reduced.

How much impact will *your* load stand *and still* give you a satisfied customer at destination?

BAUSCH & LOMB APPOINTMENT

Promotion of Victor Schroven to the newly-created position of Specialty Sales Field Manager has been announced by Bausch & Lomb Optical Company.

Mr. Schroven's duties will include field training of salesman and promotional work in connection with binoculars, rifle sights, telescopes, Animar lenses and allied products.

B_2O_3
can increase your pack as much as
2%
and here's how . . .
Due to its superior fluxing qualities, Borax will tend to reduce your batch melting time . . . while enabling you to produce a bottle with fewer checks.
Write to Stauffer's Technical Sales Division for more information about F. M. Smith Brand Borax and the way it can increase your pack and reduce production costs.
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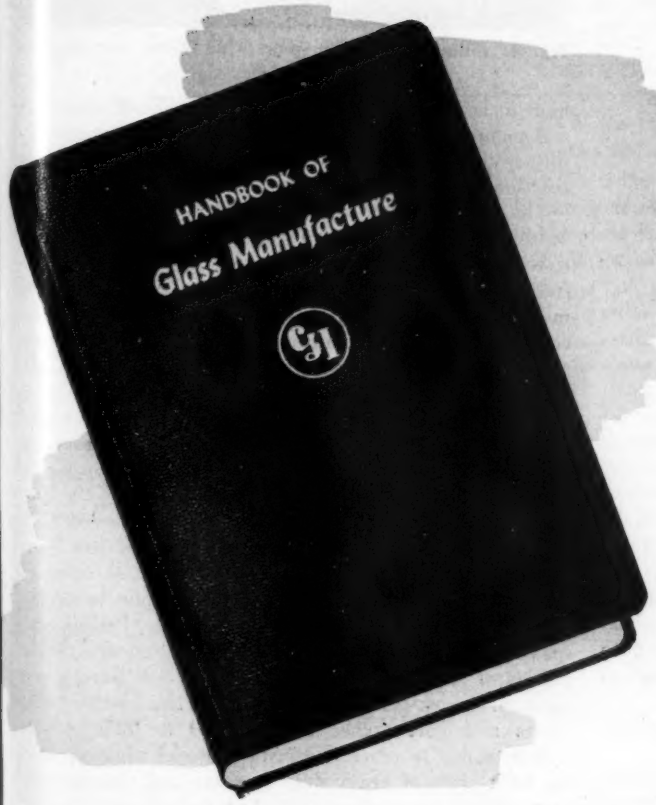
It's *new*

and it's *different*



IT'S NEW because twelve years have passed since the first handbook for glass manufacturers was published and so much has taken place in the intervening years in technological and engineering development.

IT'S DIFFERENT because it is the only single volume where so much pertaining to all phases of glass manufacture will be found.

The NEW ***Handbook of Glass Manufacture*** is comprised of more than 500 pages of practical reference data . . . tables, charts, formulae, illustrations, and text. It is a primary working tool for plant executives, research heads, laboratory technicians, and engineers. It is a reference book that should be immediately available when you have a question or need a quick start to the solution of a problem. It is edited for glassmen by those who know glass.

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COMPANY .....

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(*Continued from page* 196)

packages, unit containers, loading methods, cushioning, bracing, blocking plans, etc. The same variables of rough handling, routing, weather and shipping conditions are effective upon both packages being studied. End-wall areas can be studied conveniently without interrupting the loading of the rest of the car. The proper packages, cushioning, etc. to be used in end zones may be determined.

Valid comparisons may be obtained with fewer experimental shipments than when there is no effective control over the shipments. Controlled shipments should be repeated until significant results are obtained. The number of shipments will depend upon the breakage experience. The "Split Load" experimental shipment is strictly a comparative method. It is not suitable for the measurement of an absolute damage picture.

Special Refractories for Superstructure and Feeder Parts

By Robert W. Knauft
Chas. Taylor Sons Company, Cincinnati, Ohio

The furnace pressure, temperature, velocity of gases, the concentration of fluxes in the gases and rate of pull are the important factors which determine the life of the refractories in the furnace superstructure.

The fluxes in the furnace gases more than any other factor are responsible for the destruction of refractories in the superstructure. Silica brick could be used safely at even higher temperatures than those which are generally found in continuous glass tanks, if it were not for the presence of lime and alkalis. The greatest damage is done to the melter superstructure by the fluxes which are carried in the batch dust as solids. Deposit of sodium sulfate and boron compounds have been observed in the cooler parts of the regenerators and in the exhaust stacks of the feeder forehearths. Improved methods of charging and fritting the batch, wider ports and reduced gas velocity tend to reduce the amount of batch dust which may be carried in the furnace gases, contributing to longer refractory life, less clogging of checkers, and to better glass quality.

With oil firing, the ash from the oil may be relatively

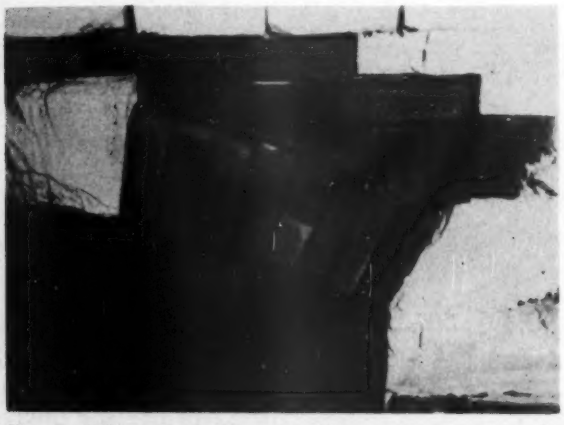

Fig. 1. Sillimanite brick used *without* preheating to make hot repair to silica port arch in continuous glass container tank. Furnace ran for an additional 10½ months after this repair had been made.

Fig. 2. Sillimanite feeder spout with fusion cast inserted tube seat.

high in sulphur or soda and contain traces of vanadium and manganese. These fluxes will attack the superstructure if they are deposited on the hot face. The rate of reaction proceeds most rapidly under reducing conditions.

The rapid erosion of silica refractories under severe conditions is due to both the composition and the relatively high porosity of silica brick. Bonded mullite refractories, containing 59 to 68% alumina, are attacked much more slowly than silica when exposed to the same conditions and they have the property of becoming vitreous and dense on the surface when exposed to the fluxes which are deposited from the batch dust. Siliceous liquids (drop or wash) will readily dissolve bonded mullite and other high alumina refractories. When merely in contact with silica and with the latter not running or dripping, there is no noticeable reaction.

Generally speaking, the performance of bonded high alumina brick refractories in glass furnaces has been disappointing. High alumina grades made of calcined diaspore are not volume stable and continue to shrink after continued use at service temperatures. Peeling and spalling of the shrunken hot face usually occurs. Some grades of 50, 60 and 70% alumina brick have given good service as glass tank checkers. Plate blocks, tuckstones and port arches made of 90 to 92% Al_2O_3 bodies tended to crack, laminate and peel when used in the back ports of heavy duty furnaces and observations over several years show that they do not stand up as well as bonded or fused cast mullite and the special fused cast refractories.

Dry-pressed bonded mullite brick and special shapes of similar structure and density have excellent resistance to cracking from heat shock. Consequently, these refractories are very popular for use as expendable feeder parts and for making hot repairs to glass furnace crowns, walls, arches and tuckstones. Bonded mullite brick and even large blocks are frequently set in place without any preheating.

Bonded mullite refractories are produced by power pressing, hand molding, pneumatic ramming, extrusion and by the slip cast methods. Grain sizing, composition, porosity and density may be varied to meet the individual service condition. A recent development is the sillimanite spout fitted with an inserted tube seat made

(*Continued on page* 226)

WHERE GLASS MANUFACTURERS USE B&W REFRACTORIES *for Longer Campaigns*

These glassmakers proved to themselves that B&W's specialized refractories paid off in longer campaigns. Why not use them in your tanks?

PLANT	LOCATION OF B&W REFRACTORIES
New York Manufacturer of Container Glass	B&W Dense 80 Firebrick in 1st & 2nd ports. B&W 80 Firebrick in checkers.
Ohio Manufacturer of Clear Glass	B&W 80 Firebrick in port construction, regenerator arches and walls, and top 8 to 10 courses of checkers. B&W Juniors in wall type checkers. B&W Allmul burner blocks.
Ohio Manufacturer of Container Glass and Colored Borosilicates	B&W Dense 80 and Junior Firebrick in checkers. B&W Dense 80's in burner block necks and B&W Juniors in ports.
Pennsylvania Manufacturer of Container Glass	B&W 80 Firebrick in ports, regenerator arches and walls as well as top 10 to 14 courses of checkers.
West Virginia Manufacturer of Glass for Fluorescent Lamps	B&W Junior Firebrick in checkers and ports.
Kentucky Manufacturer of Glass for Bulbs	B&W 80 Firebrick in ports, and B&W Junior Firebrick in checkers.
West Virginia Manufacturer of Plate and Window Glass	B&W 80 Firebrick in ports and regenerator crowns.
Pennsylvania Manufacturer of Container Glass	B&W Allmul Firebrick used in complete refining end.

PROPERTIES OF B&W HEAVY FIREBRICK

	B&W ALLMUL	B&W 80	B&W JUNIOR
Recommended use limit, F	3200	2950	2850
Fusion point, F	3335	3190	3173
Hot load strength, % deformation, 25 psi, 1½ hours	Less than 2% @ 3050F	Less than 1% @ 2640F	Less than 2% @ 2640F

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B475

RADIOACTIVE TRACERS . . .

(*Continued from page* 184)

The last application on my list was the first we undertook in January 1948. At that time one of our processes involved the treatment of a metal mirror film on plate glass. The treatment was with a chromium bearing solution. We wanted to know if any of the chromium was left on or in the film after thorough washing and rinsing. A tracer of chromium 51 was added to an experimental batch of solution, and sample mirrors were treated as usual. Counting of the film after rinsing showed that no more than 1 microgram of chromium per square centimeter was left. This proved that no chemical reaction of chromium with the film had taken place. The experiment illustrates the value of the negative result, which we sometimes lose sight of in our efforts to emphasize positive significance. Thus there is value in results sunk in the "background count" that we try so hard to eliminate from our activity readings.

The authors wish to acknowledge with thanks the helpful translation of M. Peyches' article by Miss Rita Brantlinger, Research Librarian.

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BABCOCK & WILCOX EXECUTIVE CHANGES

M. Nielsen, Vice President of The Babcock & Wilcox Company, has been elected a member of the Board of Directors and placed in charge of the company's Boiler Division, according to an announcement by Alfred Iddles, President. The appointment fills a vacancy created by the death of J. H. King.

Mr. Nielson joined Babcock & Wilcox in 1924 and has had wide experience in the erection, contract and manufacturing departments of the company.

Also announced was the appointment of W. D. Sullivan as Vice President of the company. Mr. Sullivan was also placed in charge of the manufacturing department of the Boiler Division. Formerly regional manager of the manufacturing department, Mr. Sullivan fills the vacancy caused by Mr. Nielsen's promotion. He has been associated with the firm since 1916.

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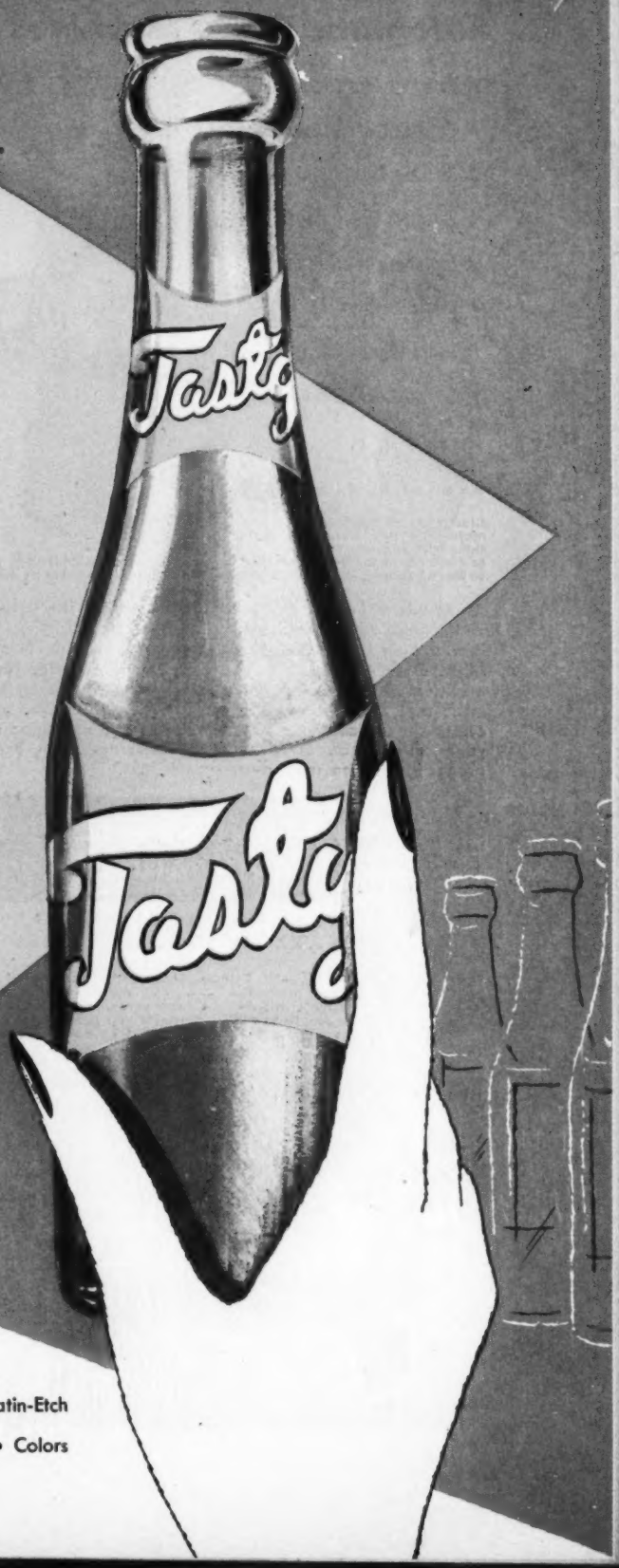

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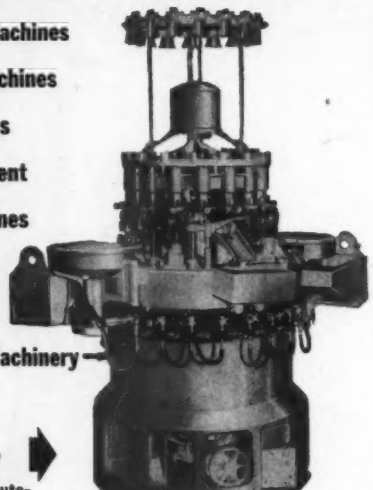

Illustrated at right—Automatic Hot Cut Flare Machine with capacity of 3000 to 4000 pieces per hour. Universal upper chucks accommodate No. 27 to No. 44 tubing. Micrometer adjustments for cutter and flaring tool.

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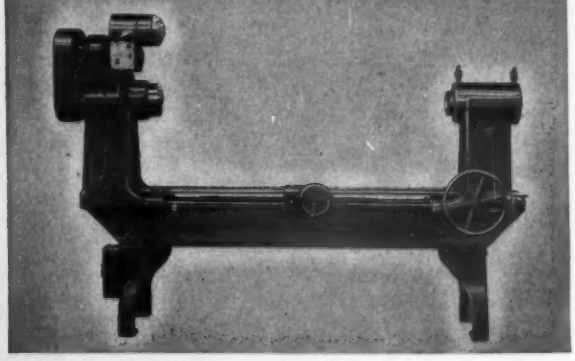

RESEARCH DIGEST . . .
(*Continued from page* 203)

zirconia tetrahedron. The chance of such a "break" occurring between two SiO_4 tetrahedra is greater than the chance of a similar "break" occurring between two adjacent ZrO_4 tetrahedra in an alkali-zirconia glass because the bonding between two ZrO_4 tetrahedra is stronger than between two SiO_4 tetrahedra. Consequently in the alkali-zirconia glass, any zirconia which has not become part of the glass structure will have a smaller chance of getting into the structure at a "break" between two ZrO_4 tetrahedra than it would have in getting into a "break" between SiO_4 tetrahedra.

A similar argument could be put forward to explain why zirconia is taken up more rapidly in an alkali-borate glass than in an alkali-zirconia glass.

The increase in the reaction rates in the zirconia-alkali mixtures, which could be produced by the addition of boric oxide or silica, is much less than the increase produced by similar additions to alumina-alkali mixtures. This can be attributed to the differences in the dissociation energies of zirconia (485 k. cal./gm. mol.) and alumina (317-402 k. cal/gm. mol.).

The increase in reaction rates with zirconia which can be produced by the addition of silica gel or boric oxide to a zirconia-alkali mixture is higher with lower zirconia-silica or zirconia-boric oxide ratios, which provides further evidence that the presence of silica or boric oxide increases the tendency of the zirconia to combine with alkalis or alkaline earths.

(4) The various alkalis, arranged in decreasing order of their reaction rates with zirconia, can be placed as follows: K_2O, Na_2O and Li_2O when they are present in molecularly equivalent quantities.

(5) The progress of the reactions between zirconia and the other mixtures could be represented by equation (1). This shows that the glassy layer formed during the reactions with zirconia builds up progressively around the core of unaltered zirconia. This was not unexpected, since the introduction of only small amounts of zirconia to silicate and borate glasses is known to cause a very marked increase in viscosity.

The value of the factor a in equation (1) decreased with the increase of reaction rates.

CURRENT STATISTICS . . .
(*Continued from page* 204)

period ending January 1954, a total of 38,863,862 dozens have been sold. This is 6.9 per cent less than the 41,783,974 dozens sold during the 12-month period ending January 1953.

• Raymond Szymanowitz has been appointed Executive Vice President of Acheson Industries, Inc., at a Board of Directors meeting recently held. Mr. Szymanowitz formerly served as Vice President.

• Stauffer Chemical Company has announced the removal of its New York headquarters from 420 Lexington Avenue to 380 Madison Avenue, New York 17, New York. The new telephone number is OXford 7-0600.

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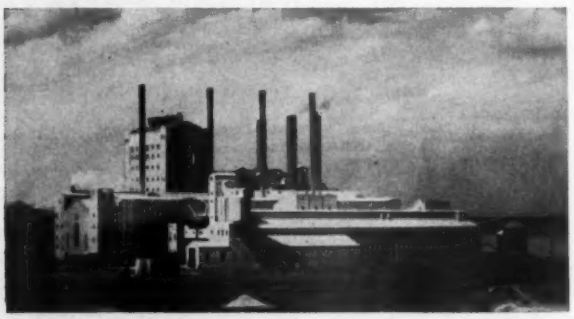
Milestones in Glass Progress

PHOTO COURTESY TOLEDO MUSEUM OF ART

1675 The first flint glass was developed in England in 1675 by George Ravenscroft; this glass vase is a sample of his handiwork. English glassmakers of the 17th century, forbidden to burn wood, turned to using coal as fuel. Coal provided the intense heat needed for flint-glass making—and unquestionably aided Ravenscroft in his discovery!



1890 Michigan Alkali Company, now a division of Wyandotte Chemicals Corporation, was founded by Captain J. B. Ford to supply Soda Ash to the glass industry; part of Wyandotte's modern Soda Ash facilities is shown above. Wyandotte has literally grown up with glass. Today, as in the past, it is a working partner, supplying technical assistance and raw-material chemicals to those great companies marking milestones in glass progress.

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Founded by a Glassmaker to Serve the Glass Industry

SUMMARIES OF CONFERENCE PAPERS . . .
(*Continued from page* 220)

of a fused cast zirconia-alumina refractory. These spouts have given outstanding results in a number of plants melting soda-lime container glasses, especially on double gob operation. All zircon spout and orifice rings are doing an outstanding job in contact with borosilicate glasses.

In feeders, these special refractories have replaced conventional fire clay, kaolin and silica parts, both above and below the glass line, and give longer life, increase glass quality, provide better and more uniform control of the drop and have increased production. The rate of erosion is less; hence, fewer shut-downs for replacing worn out parts. Less refractory is dissolved in the glass, minimizing the percentage of ware rejections which can be traced to the forehearth refractories. Bonded mullite and/or zircon refractories will not drop and as they are low in iron, any glass which condenses on the exposed faces of the refractory, above the metal line, will remain relatively clean. "Cat's eyes" and "tadpoles" are thereby eliminated.

Although bonded zircon refractories have been made commercially for over twenty years by several manufacturers, they have been used by the glass industry to a limited extent. During the past five years, several manufacturers of glass containers and special glasses and the fiber glass industry have used bonded zircon refractories most effectively in furnace construction.

Zircon refractories show promise when used in contact with silica refractories or as a separating media between silica and the several types of high alumina and alumina-silicate refractories, including those which are fused cast. Zircon is an acid refractory and does not react with silica to any appreciable extent at service temperatures nor are they severely eroded by silica wash. Zircon is, however, readily attacked by alumina bearing wash or slags and for this reason should not be set below or bonded into alumina bearing refractories. Zircon refractories have given good service when used in the superstructure as port baffle blocks, burner blocks, port jambs and arches, tuckstones, peephole blocks and as pyrometer blocks set into the silica crown. Experiments are now being made with zircon brick as drip courses, replacing silica, to prevent silica wash from eroding the breastwall, port jambs and tuckstones.

Standard zircon-dry pressed brick, uniformly dense and accurately sized, have been used to excellent advantage for paving both used and new clay bottom blocks in both soda-lime flint and dense, opal glasses.

The fiber glass industry has made effective use of both standard and special dense zircon refractories in the small furnaces used for melting special glasses for making super-fine fibers, both above and below the metal line. Zircon tank blocks and parts of the superstructure have given good service in tanks melting borosilicate glasses.

There is no perfect, all-purpose refractory and zircon, too, has its limitations. Zircon is subject to dissociation at temperatures above 2800°F. and at lower temperatures in the presence of certain fluxes. Batch carry-over, furnace atmosphere and pressure may accelerate this phenomenon. Zircon refractories show considerable promise when used properly in the superstructure, below the

glass line and as feeder parts in contact with borosilicate and dense opal glasses. It is hoped that the completion of development work now in progress will result in other types of zircon refractories which will be more universal in their application in glass furnaces.

1953 ANNUAL REPORTS

Net earnings of General Refractories Company for 1953 amounted to $4,206,270, or $4.26 per share, according to that company's 1953 annual report. Corresponding figures for 1952 were $4,329,852 and $4.38 per share. The company reported sales of $51,766,834, which represents an increase over 1952 sales of $49,945,218.

Sales for Babcock & Wilcox Company amounted to $305,746,000, which was the highest in the history of the company. This exceeds by one-third the record of $241,267,000 established in 1952. Net income for 1953 was $12,061,000, as compared with $9,809,000 for 1952.

Thatcher Glass Manufacturing Company, Inc. reports net sales of $32,597,492 for 1953, compared with $27,744,109 for 1952. New income was $1,246,651 for 1953, compared with $990,575 for 1952.

Sales for Mathieson Chemical Corporation were reported to be $243,575,544 during 1953. This compared with $147,109,581 reported for 1952, and with $215,662,550 on a pro-forma basis for Mathieson and Squibb combined for the year 1952. New profit was $18,755,813, equivalent to $3.20 per share, compared with $14,503,152, or $3.44, for 1952.

Aluminum Company of America's consolidated 1953 net income was $48,848,094, compared to $43,527,142 in 1952. After deduction of dividends on Cumulative Preferred Stock, net income per share in 1953 amounted to $4.71, as compared to $4.19 in the preceding year. Revenues from sales, services and other sources in 1953 amounted to $711,073,898, compared with $584,005,750 in 1952.

The annual report of Glass Fibers, Inc. reported profits for 1953 in the amount of $211,205 after taxes. This compared with a loss in 1952 of $79,324. Net sales in 1953 were $6,395,620, compared to $4,183,230 in 1952, an increase of 52.9 per cent.

Sales for 1953 reported by Foote Mineral Company were $8,171,773, and while a new record for the company, they were only slightly above those of 1951 and 1952. Net income on the common stock for 1953 was $1.01 per share after dividends on the preferred stock, as compared with $1.23 in 1952 on a lower number of shares.

Net sales reported by American Potash & Chemical Corporation were $22,461,056 for 1953, compared with $18,049,179 for 1952. Net income was $2,116,082, equal to $4.01. In 1952, net income was $1,670,555, equal to $3.26 per share.

Corning Glass Works reported sales amounting to $149,294,036 in 1953, compared with $126,455,784 in the previous year. Net earnings after taxes were $12,681,395, or $4.66 per share of common stock, compared to $10,323,156, or $3.77 per share, in 1952.

• Chester A. Marcowka, formerly with the A. O. Smith Corporation, has been named a full ceramic engineer in the Armour Research Foundation's Ceramics and Minerals Department at Illinois Institute of Technology.

FACT: *in grinding glass* — metal bonded diamond wheels grind faster, at lower cost and with less spoilage than any other known method.

FACT: *in grinding carbides* — nothing cuts as fast, as cool and as economically as a diamond wheel.

FACT: *in dressing grinding wheels* only diamond dressers will do the job where fine finish, high production or intricate forms are involved.

FACT: *in lapping* — diamond compounds and powders save countless skilled man-hours by producing wanted sizes and finishes faster.

FACT: *in cutting* — diamond cutting and boring tools are standard for tough jobs where the best of competitive materials fail.

FACT: *in sawing* — diamond saw blades feature speed and economy on quartz, concrete, stone, sapphire, glass and diamond.

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PPG ISSUES GLASS TECHNOLOGY LIST

Pittsburgh Plate Glass Company's Glass Division Research Laboratories has announced publication of a List of Subject Headings for Glass Technology.

This List is a joint compilation of the libraries of the Pittsburgh Plate Glass Company, Glass Division Research Laboratories, and Corning Glass Works. It represents mainly the headings adopted in the cataloging of the material of the two companies. Included are those headings which are closely allied to glass and glass technology.

STATE UNIVERSITY OF IOWA ANNOUNCES MANAGEMENT COURSE

The College of Engineering, State University of Iowa, has announced the Fifteenth Management Course to be held June 14 through June 26, 1954, in Iowa City.

This is an intensive course for factory managers, foremen, industrial engineers, methods and time-study analysts, cost accountants and office executives. The areas of Production Planning, Job Evaluation, Motion and Time Study, Wage Incentives, Plant Layout, Materials Handling, Quality Control, Supervisory Training, Labor Relations and Legislation, Organization and Policy, and Public Speaking are included.

• A three-week symposium on enamels will be held at the State College of Ceramics, Alfred University, beginning June 8, according to an announcement of Dean John F. McMahon and Professor Robert M. Campbell, Chairman of the Ceramic Engineering Department.

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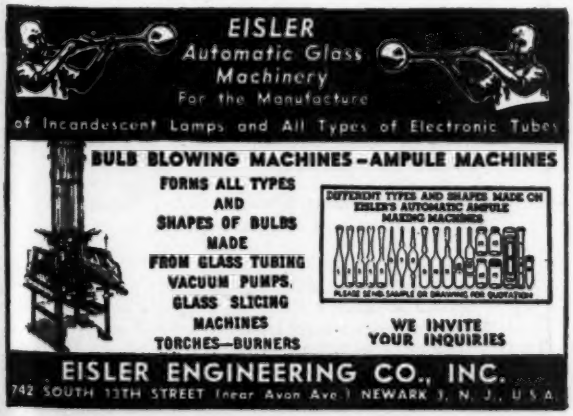
DR. F. E. WASHER NAMED CHIEF N.B.S. OPTICAL INSTRUMENTS SECTION

Dr. Francis E. Washer, a widely recognized authority in the field of optics, has been appointed Chief of the Optical Instruments Section of the National Bureau of Standards. Dr. Washer has been an N.B.S. staff member for 19 years, during which time he has published 20 scientific papers dealing with airplane camera lenses, telescope pointing and resolving power of lenses.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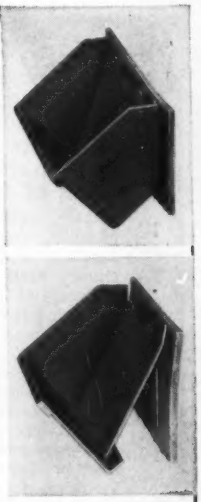

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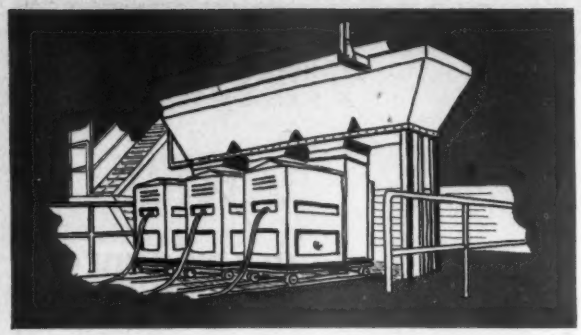

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